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The Hydrologic-Economic Model of the San Joaquin Valley

Appendix C
Final Report
San Joaquin Valley Hydrologic-Economic Modeling Study

December 1982

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FINAL REPORT
SAN JOAQUIN VALLEY HYDROLOGIC-
ECONOMIC MODELING STUDY

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1. INTRODUCTION

1.1 STUDY BACKGROUND

This report is the culmination of a two-year study by Auslam and Associates, Inc. (A&A), and Resource Management Associates (RMA) for the California Department of Water Resources. The purpose of this study was to develop a hydrologic-economic model of the San Joaquin Valley. The motivation for this modeling effort comes from concern over the overdraft situation in the Valley. Although much of the Valley's agricultural development and urban growth has occurred because growers were able to utilize their groundwater basins, it is felt that in order to maintain this current level of agricultural activity and to have a successful future it is necessary to manage groundwater resources in both an economically and hydrologically efficient manner.

This modeling effort will enable water planners to determine how groundwater levels will fluctuate under different water management scenarios. Thus, many different hypothetical scenarios can be posed and the model results can be used to help planners predict and possibly prevent serious water management problems that Valley residents could confront in the years ahead. The modeling effort thus provides water planners with a tool in which a wide range of experimentation with different water policies is possible. Since it is not often possible or desirable to experiment with different groundwater management plans in a real world setting, the hydrologic-economic modeling effort will allow policy makers to see the possible results of different management plans within a modeling frame and thus avoid the risk of possibly disastrous failure by implementing a policy and observing how it works in reality.

Two other benefits also accrue from the construction of the hydrologic-economic model. First, the actual excercise of building the model allowed for a greater understanding of the complexity of hydrologic and economic aspects of the Valley's agricultural sector. Secondly, having built the model it is possible to analyze it mathematically to help suggest courses of action that were not otherwise apparent.

The hydrologic-economic modeling effort resulted in the development of four models, two hydrologic and two economic. These four models make up what is called the Hydrologic-Economic Modeling System (HEM). These models are a Surface Water Allocation Model (SWAM), a finite element Groundwater Model (GWM), an Agricultural Production Model (SJVPM), and a Linear Quadratic Control Model (LQCM). The HEM system and each of the models are discussed in the following chapters of this report.

These models, a data base management system which both pre-processes the data necessary to run the models and post-processes the results, and the data base for the models have been turned over to DWR. The system is currently running on DWR's CDC7600 computer in Sacramento, California.

As part of this effort the models making up the HEM system were verified both individually and as a system. The individual verification procedures are discussed in Chapters 3, 4, and 5. Each of these individual models has turned out to be an extremely good tool for use by water planners.

The verification of the HEM system, that is all of the individual models working together, was done by running two hypothetical scenarios. These scenario runs were done to demonstrate the HEM proficiency. A description of the scenarios is provided in Chapter 6. It should be emphasized that although the results of these two runs were interpreted in a policy context this was done so that the power of the HEM system could be demonstrated. These policy interpretations should not be viewed as DWR policy. They are presented to show how the HEM system can be used to aid in water management planning. The scenario runs show that the HEM system, given a set of assumptions concerning future economic and hydrologic conditions, can provide a tremendous amount of information that can be very useful in helping water planners evaluate different water management scenarios.

1.2 SCOPE OF THE REPORT

The remainder of the report is divided into six chapters. Chapter 2 provides a brief description of the four component models in the HEM system and a

discussion of how they interact. A summary of the inputs and outputs of the HEM system is provided.

Chapter 3 provides a description of the Hydrologic models -- SWAM and GWM. Each model is discussed in terms of its basic concepts and data requirements. This chapter concludes with the hydrologic model simulation results for a 1970-1977 base period.

Chapter 4 provides a description of the San Joaquin Valley Production Model (SJVPM). The three components making up this model are discussed. The use of the SJVPM to provide a data base for the derived water demands is reviewed, and validation of the SJVPM is discussed.

Chapter 5 contains a description of the LQCM. A discussion of the theoretical concepts behind the LQCM and its component parts is provided.

Chapter 6 contains information on the two scenario runs done using the HEM system. The scenarios are discussed and the results and summary of the two scenario runs are given.

Chapter 7 provides a summary of the modeling study. It contains a discussion on the HEM system's ability to act as a tool for assisting policy makers in the decision making process and some suggestions for improving the system.

Finally, in addition to this final report there is a series of technical reports and data appendices which provide a more indepth explanation of the different models making up the HEM system.

2. OVERVIEW OF THE SAN JOAQUIN HYDROLOGIC - ECONOMIC MODELING SYSTEM

2.1 GENERAL MODELING APPROACH

The purpose of the San Joaquin groundwater modeling effort is to provide the Department of Water Resources with a modeling system for predicting the impacts of alternative water supply and consumption scenarios. These impacts could include changes in land use, cropping patterns, farm income, irrigation technologies, groundwater depths, and groundwater pumping costs. In order to emphasize the importance of both hydrologic and economic factors, the San Joaquin groundwater modeling system is referred to here as the Hydrologic-Economic Model (HEM). This modeling system is composed of four submodels which can be used alone or in various combinations. Two of the submodels deal with surface and subsurface aspects of Valley hydrology, one submodel deals with economic production, and one submodel combines hydrologic and economic information. Each of these is briefly described below.

The first of the two hydrologic submodels is the surface water allocation model (SWAM). SWAM allocates surface water from available sources among water users, taking into account defined institutional and conveyance constraints. It then sets up a water budget (i.e., an accounting of all inflows, losses, and outflows in a specified area) assuming a pre-specified cropping pattern in agricultural regions. SWAM's inputs include a detailed description of the Valley's surface water distribution system, land use, annual precipitation, crop evapotranspiration properties, irrigation efficiencies, and information about artificial recharge, conveyance losses, and other elements of the surface water budget. SWAM's primary outputs are annual surface water diversions, groundwater pumpage (computed as a residual in the water budget), and net recharge to the groundwater basin.

The second hydrologic submodel is a layered groundwater model (GWM) which can simulate flow in the Valley's two main aquifers -- the unconfined aquifer above the Corcoran clay and the leaky confined aquifer below the Corcoran clay. This model depends on annual pumpage and recharge values generated by SWAM. Other GWM inputs include geohydrologic properties such as hydraulic

conductivities, aquifer depths, moisture deficiencies, and subsidence characteristics. GWM's primary outputs are the average unconfined and confined heads in specified areas of the Valley. A pre-processing program called RMA1 is often used to prepare geometric input data for GWM. Also, a post-processing program called FLUX can be used to estimate sub surface fluxes.

The economic component of the HEM system is the San Joaquin Valley Production Model (SJVPM). The SJVPM is a quadratic programming model of farm-level production which allocates resources by maximizing consumer surplus and farm income subject to a set of water, land, and institutional constraints. The production model depends on annual surface water allocations computed by SWAM as well as crop budgets for all cropping activities considered. Other inputs include the coefficients for the model's crop price forecasting equations. The SJVPM may be run under a variety of water supply conditions to provide the information needed to estimate water and groundwater demand functions. The SJVPM also computes regional changes in farm income, cropping patterns, irrigation technologies, and land use.

The final model in the HEM system is the Linear Quadratic Control Model (LQCM). This model links the hydrologic and economic components of the San Joaquin modeling effort and is the primary tool for evaluating policy alternatives. The basic purpose of the LQCM is to compute the optimal groundwater pumpage allocation which maximizes the sum of the "producer's rent" derived from current groundwater use and the "social value" of groundwater remaining in storage. The producers' rent can be defined as the profits that water users capture in the process of using water in some productive process. Alternatively, it can be defined as the returns gained from using the water above its cost. The social value of the groundwater represents the gains to be made from using the groundwater so that the discounted net marginal value (the return to the next acre-foot extracted from the groundwater basin) of the groundwater is equal across time. The reason that this is not always the case in groundwater use is that individual users of the water in an attempt to maximize their individual returns from using the groundwater do not account for the costs that their pumping has on other users. This lack of accountability creates the so-called "Tragedy of the

Commons". The tragedy is that if instead of reacting only to the private costs of using the groundwater each user were to react to the social cost (the private cost plus the cost inferred on other users) each would be better off in the long run. That is, each would share in the reduced pumping cost savings over time and the additional availability of groundwater. This benefit is referred to as the social value of the groundwater. Thus, the LOCM maximand forces the maximization of both the current and future value of the groundwater. That is, it assumes that all users are acting collectively to maximize the value of the resource overtime. The producer's rent is inferred from the groundwater demand functions derived from the SJVPM while the social value is measured by the marginal cost of groundwater pumping. The economic maximization of producer's rent and social value is constrained by a set of equations relating the quantity of groundwater pumped to the average pumping lift (or, equivalently, pumping cost). These constraint equations are estimated from the outputs of the groundwater flow model GWM.

The temporal and spatial scales of the various components of the HEM system are determined largely by the availability and detail of the relevant input data. The economic and surface water data required by SWAM and SJVPM are readily available only at the spatial scale of the Department of Water Resources' Detailed Analysis Units (DAU). The 33 DAUs defined in the San Joaquin Valley study area vary in size from 43,000 acres to 635,000 acres.[1] Their boundaries generally correspond to local water agency boundaries, although a typical DAU may contain several distinct agencies. The temporal scales of SWAM and SJVPM are similarly limited by data availability to annual totals or averages, depending on the variable in question. Since the LQCM depends on information from both SWAM and SJVPM, its spatial scale is at the DAU level and its temporal scale is based on annual time steps. Since geohydrologic considerations make the DAU level spatial scale too coarse for the groundwater flow modeling, the basic spatial units used in GWM (called

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1/ Note that although there are 33 DAUs in the study, DAU 260 is hydrologically modeled with DAU 261 and is separated back out for economic analysis.

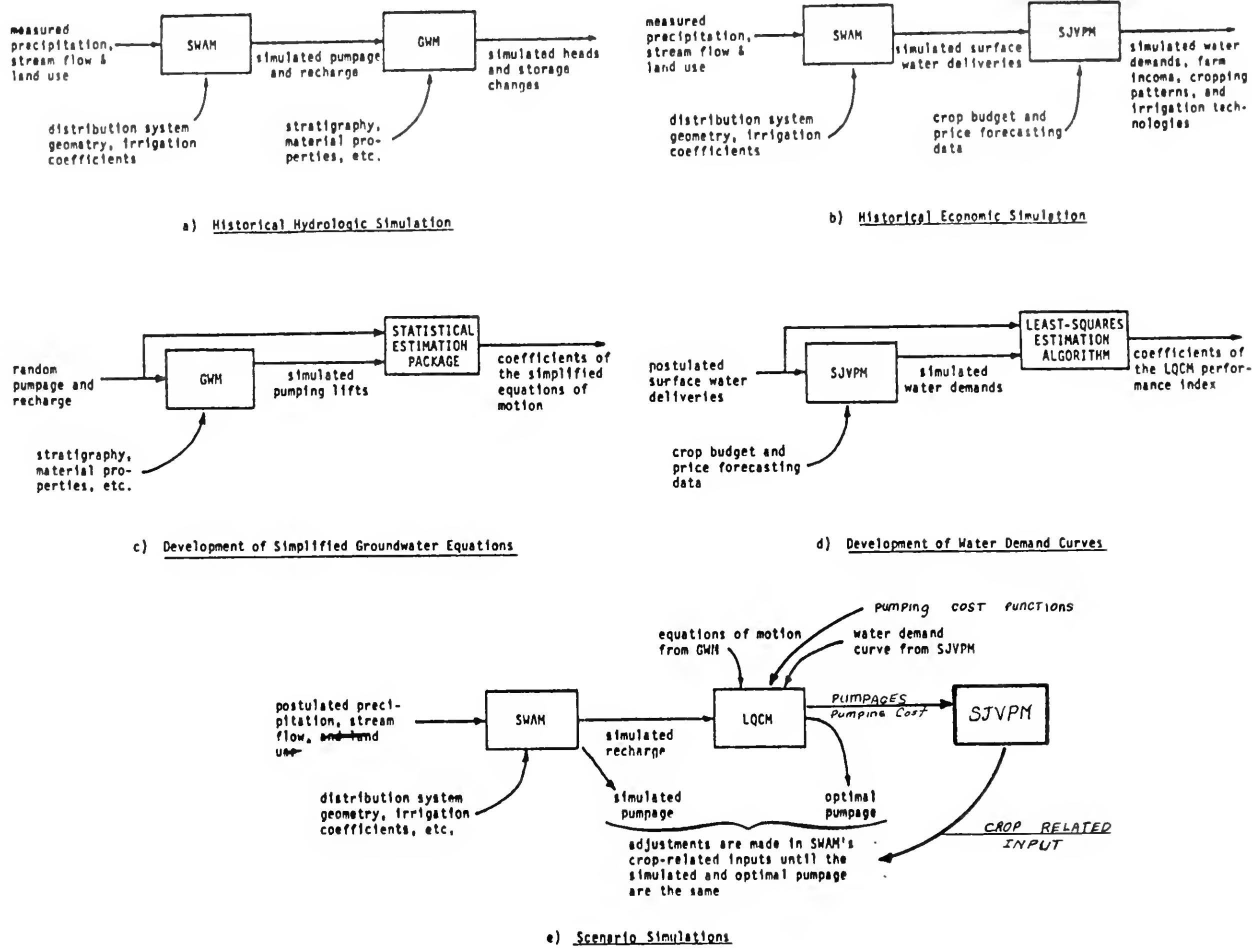


FIGURE 2-1

PRIMARY MODEL CONFIGURATIONS USED IN THE SAN JOAQUIN VALLEY GROUNDWATER STUDY

elements) are significantly smaller than a typical DAU. On the average there are about seven or eight elements in each DAU. Geohydrologic considerations also make it preferable to use semi-annual (six-month) time steps in GWM, rather than the coarser annual time steps adopted in the other HEM submodels. This requires that the annual pumpage and recharge values computed by SWAM be divided into winter and summer contributions before the groundwater flow computations are made.

The four models described above can be arranged in a variety of ways to achieve a particular objective. The primary model configurations used in the San Joaquin study can be summarized as follows (see Figure 2-1).

1. Historical Hydrologic Simulation

   Surface and subsurface hydrologic conditions over a historical period can be simulated with SWAM and GWM combined as shown in Figure 2-1a. Time-dependent inputs such as stream flows, precipitation, and land use are provided, together with a number of time-invariant inputs describing the geometry and physical properties in the Valley's surface water distribution system and groundwater aquifers. SWAM is used to simulate pumpage and recharge over the historical base period. These become inputs to GWM, which is, in turn, used to simulate changes in head and groundwater storage. The results of the base period simulation can be compared with historical head measurements to provide a check on model accuracy. This application is discussed in Chapter 3 of this report.

2. Historical Economic Simulation

   Economic conditions over a historical period can be simulated with SWAM and the SJVPM combined as shown in Figure 2-1b. This model application serves a purpose analogous to the historical hydrologic simulation discussed above. SWAM is used to compute total surface water availability, one of the constraints included in the SJVPM's description of the San Joaquin Valley agriculture. Crop budget and price forecasting data supplied by the model user complete the SJVPM problem specification. The SJVPM predicts water demands, farm income, and cropping patterns over

the historical simulation period. These predictions may be compared to recorded economic data to provide a check on model accuracy. Historical economic simulation for the San Joaquin Valley is discussed further in Noel (1982a).

3. Development of Simplified Groundwater Equations

In certain situations it is useful to have a simplified model of groundwater basin behavior which reproduces general trends on a less detailed level than the layered groundwater model described earlier. A particularly useful simplified model consists of a set of linear difference equations (sometimes called "equations of motion") which predict average DAU pumping lifts from total annual DAU pumpage and from multi-year randomly varying sequences generated by the detailed groundwater model. The third San Joaquin model configuration, shown in Figure 2-1c, provides such sequences. In this configuration GWM is run with its usual time-invariant inputs (stratigraphy, material properties, etc.) but the time-varying pumpage and recharge inputs are supplied by an internal random number generator. The resulting pumping lifts are passed, together with the pumpage and recharge variables, to a standard statistical estimation package which computes the coefficients of the simplified equations of motion. This process is discussed in more detail in Chapter 5 and in Noel (1982c).

4. Development of Water Demand Curves

The performance index of the linear quadratic control model is based, in part, on a water demand relationship which relates the quantity of groundwater pumped to its present and future value. This relationship may be summarized with a demand curve constructed from the outputs of several different SJVPM simulation runs. The demand curve estimation process is analogous to the equation-of-motion estimation procedure described above. The SJVPM is run independently of SWAM since the surface water availability is input directly by the user (see Figure 2-1d). Several different availability levels are used to define several

points on the demand curve, which is then fitted with a least-squares straight line. The slope and intercept of this line are input directly to the LQCM. This application of the SJVPM is discussed further in Noel (1982c).

5. Scenario Runs

The preceding four applications of the various models of the Hydrologic-Economic Model system are all used to support the scenario runs which are used to validate the HEM system. The historical simulations establish the credibility and evaluate the accuracy of SWAM, GWM and the SJVPM. The equation of motion and demand curve estimation procedures provide coefficients required by the LQCM. In the fifth modeling configuration, SWAM, SJVPM and the LQCM are run together over a long time period to provide predictions of the likely consequences of a particular water supply or water demand scenario. The models are connected as shown in Figure 2-1e. SWAM is provided with a set of surface water inputs (import facilites, irrigation efficiencies, climatic conditions) which describe the scenario of interest. These inputs include a set of postulated precipitation and stream flow values for the scenario period. SWAM is run for the designated period and its simulated annual recharge values (for each DAU) are input to the LQCM. The LQCM then computes optimal pumpages. If these pumpages agree closely with the pumpages computed by SWAM, the two models are consistent and the SWAM land use inputs describe the cropping patterns which will occur if the optimal pumpage strategy is carried out. If the SWAM and LQCM pumpages disagree, the SWAM land use inputs are adjusted and the simulation-optimization process is repeated until the pumpages are sufficiently close. In most cases, this adjustment process only needs to be repeated a few times. Figure 2-2 shows the total HEM system interactions.

The role that the GWM plays in the scenario runs and its data needs and inputs are discussed in detail in Chapter 3.

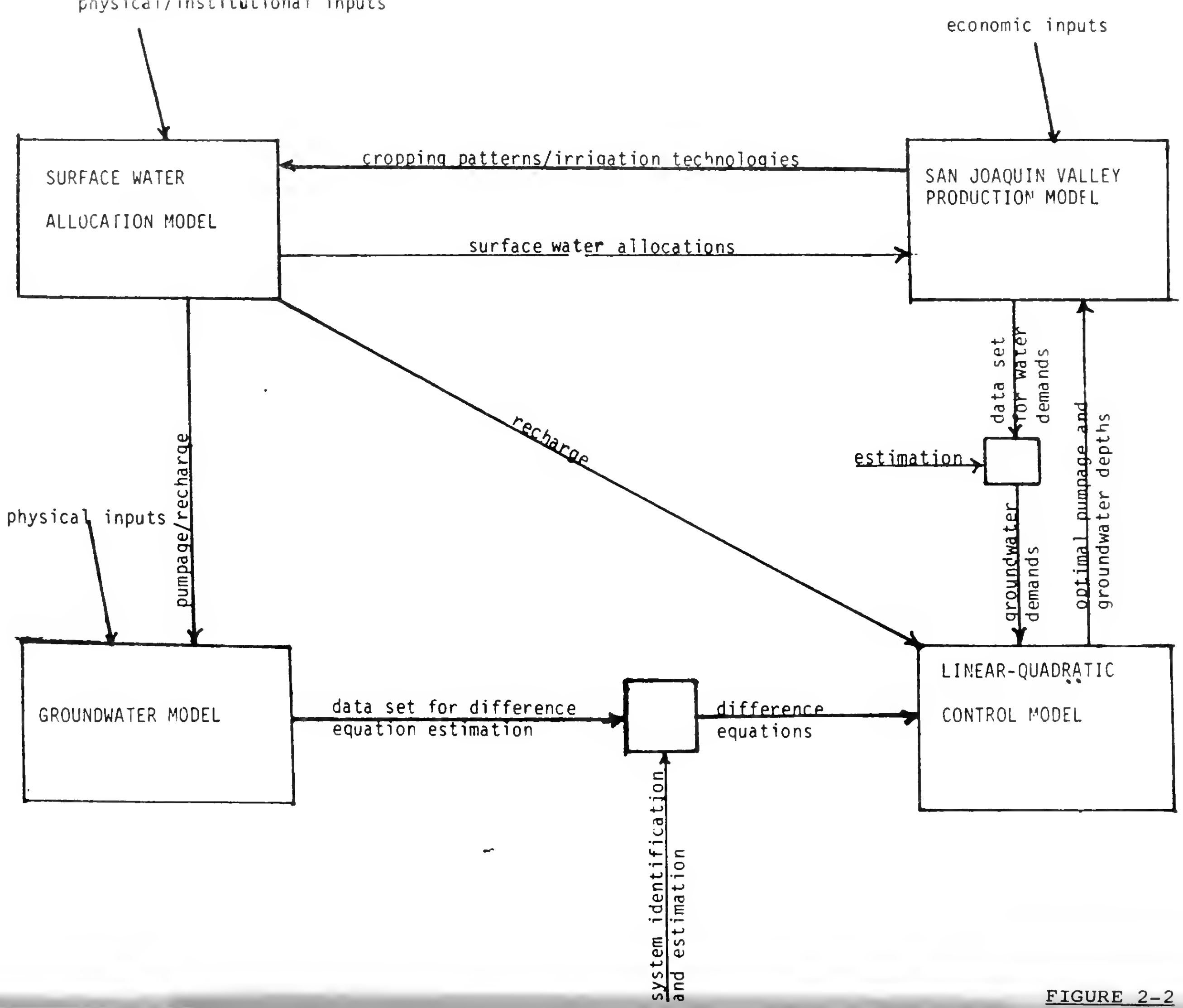

physical/institutional inputs
economic inputs
SURFACE WATER
ALLOCATION MODEL
cropping patterns/irrigation technologies
SAN JOAQUIN VALLEY
PRODUCTION MODEL
surface water allocations
data set for water demands
estimation
recharge
pumpage/recharge
physical inputs
groundwater demands
optimal pumpage and groundwater depths
GROUNDWATER MODEL
data set for difference equation estimation
difference equations
LINEAR-QUADRATIC
CONTROL MODEL
system identification and estimation

FIGURE 2-2

2.2 HEM INPUTS AND OUTPUTS

Three models are required to run the two San Joaquin Valley scenarios defined for this study. These models are SWAM, SJVPM, and the LQCM. Each has data input needs and provides output information for decision making. The inputs to these models collectively describe the hydrologic and economic parameters which define a particular scenario. For example, SWAM's network specifies the distribution facilities available for delivering input water entering the Valley for a particular scenario.

The outputs needed to run the models for different scenarios are listed in Table 2-1. This listing is not all inclusive since some of the input data needs are invariant to scenario runs. For example, SWAM's network configuration need not be changed. It should be noted that although the data set seems quite imposing it need not all be changed from scenario run to scenario run and much of the data set is generated by one model for another's use. For example, the LQCM has both time varying and time-invariant data sets. The time-invariant data set of the LQCM was obtained from the equation of motion estimation precedure discussed in Section 5.2 These coefficients describe correlations between DAU pumpage, recharge and lift in the San Joaquin groundwater basin which are invarient to different surface water distinctions as made in Scenarios 1 and 2. The time-varying LQCM inputs are derived fom total surface deliveries which depend on the scenario under investigation. These inputs are estimated from demand information provided by the SJVPM and are discussed in detail in Noel (1982c).

The outputs available from the HEM system are shown on Table 2-2. This listing indicates the large amount of information that can be obtained from a HEM scenario run. The value of the HEM system is that it allows policy makers and water planners to evaluate many different water management plans and to observe the potential economic and hydrologic outcomes.

In addition to these components of HEM, a data management system has been developed to facilitate both the handling and changing of the data base. This system is described in Noel (1982 b) and McLaughlin (1982).

TABLE 2-1

INPUTS TO THE HEM SYSTEM

SWAM	GW MODEL	SJVPM	LQCM
1) Hydrologic Inputs a) Stream flow b) Stream diversions c) Aquaduct flows d) Aquaduct diversions e) Artificial recharge f) Consumptive use g) Exports h) Spills 2) Land Use Inputs a) Crop acreage by DAU b) Unit evapotranspiration of applied water (UETAW) c) Unit evapotranspiration (UET) d) Irrigation efficiency by crop by DAU	1) Pumpage/Recharge Data obtained from SWAM	1) Crop Demands for year of analysis 2) Crop Production costs for year of analysis 3) Resource Availability for year of analysis a) land b) water available and cost by surface and ground 4) Crop acreage limitations for year of analysis	1) Groundwater Demands Functions for time period being run by DAU 2) Pumping costs for time period of being run by DAU 3) Recharge by DAU for each year in time horizon being run (obtained from SWAM) 4) Equations of Motion

TABLE 2-2

OUTPUTS FROM THE HEM SYSTEM

SWAM	GW MODEL	SJVPM	LQCM
1) Surface Water Balance Summary by DAU by Year a) Supplies b) Demands	1) GW depth by element by year (unconfined and confined)	1) Total value of crop production a) Consumer's benefit b) Net farm income	1) Optimal groundwater pumpage over a specified time period
2) Recharge/Pumpage Input file for GW Model by year	2) Groundwater depth by DAU by year (confined and unconfined)	2) Total land use by soil type	2) Predicted groundwater pumping depths over a specified time period
3) Surface Water available for crop production by year	3) Storage changes by element by year	3) Total Water use by type (ground and surface)	3) Value of groundwater left in storage
4) Groundwater used for crop production by year	4) Average DAU Groundwater pumping depth by year	4) Total crop acreage and forecast crop price	
5) Recharge by DAU by year		5) Land use by DAU	
		6) Water use by DAU by type (ground and surface)	
		7) Crop acreage allocation by DAU	

3. DESCRIPTION OF THE HYDROLOGIC MODELS OF SWAM AND GWM

3.1 THE SAN JOAQUIN SURFACE WATER ALLOCATION MODEL

3.1.1 GENERAL DESCRIPTION OF SWAM

The primary purpose of the San Joaquin Surface Water Allocation Model (SWAM) is to provide a detailed water budget which accounts for major surface water sources, demands, and losses within the San Joaquin Valley. The SWAM water budget is used to derive the regional pumpage and recharge rates needed to predict changes in groundwater levels. This budget also provides surface water delivery information used by the San Joaquin Valley Programming Model (SJVPM). Interactions between SWAM and other models in the HEM system are discussed in Chapter 2.

The SWAM program represents the surface water hydrologic system as a network of interconnected channels and junctions. The network channels represent streams, canals, or conveyance facilities which are major pathways for surface water moving within the Valley. Each channel starts and ends at a specific location represented in the network by a junction. It is convenient to define four channel types and two junction types as follows (see Figure 3-1):

SWAM Channel Types

- Main Channel (Type 0) - This channel type represents a downstream segment of a major river or aqueduct.
- Upstream Channel (Type 1) - This channel type represents the furthest upstream segment of a major river or aqueduct.
- Diversion Channel (Type 2) - This channel type represents a canal or group of canals whose primary purpose is to deliver irrigation water diverted from a major river or aqueduct to a demand junction.
- Export Channel (Type 3) - This channel type represents a canal or group of canals whose primary purpose is to carry exports, spills or agricultural return water leaving a demand junction.

SWAM Junction Types

- Demand Junction (DAU) - This junction type represents a region where diverted surface water is consumed for agricul-

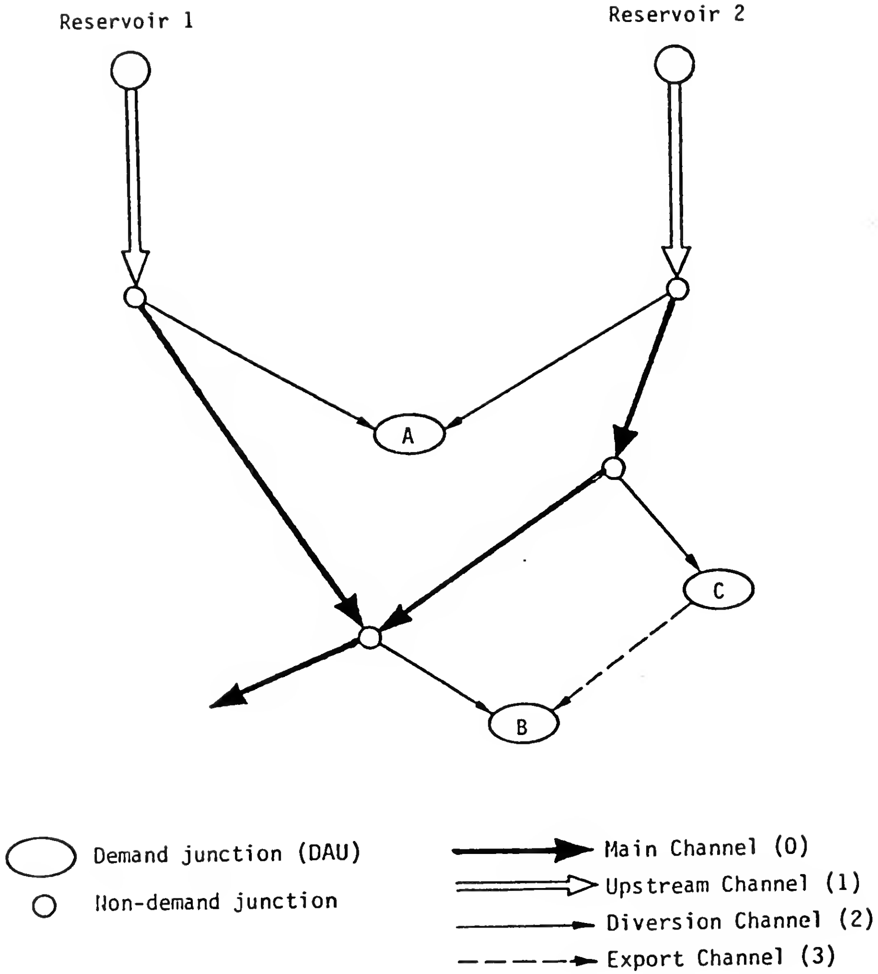


FIGURE 3-1

DEFINITION OF CHANNEL AND JUNCTION TYPES

tural, municipal and industrial (M and I), or possibly wildlife maintenance purposes.

- Non-demand Junctions - This junction type represents a location where two or more channels meet but where there is no consumption of surface water. Non-demand junctions occur most frequently at the locations of main channel diversions.

Figure 3-1 shows a typical example of the way SWAM channel and junction types may be connected to form a surface water distribution system. In this example, two upstream channels begin at reservoirs. These channels join main river channels at two non-demand junctions where water is diverted to demand junction A. Additional water is diverted further downstream to demand junctions B and C. Also, an export channel carries water from junction C to junction B.

The example illustrated in Figure 3-1 indicates that the SWAM channel and junction types provide enough flexibility to allow the model user to describe a complex distribution system where water is transferred in many ways among many different agricultural regions. When the SWAM network approach is applied to a surface system as complex as the San Joaquin Valley, the user must decide how much detail he can realistically include. In principle, one could describe deliveries down to the individual farm level, but such a network would be extremely cumbersome for an area as large as the Valley and, in any case, it would be practically impossible to obtain the diversion data and other information necessary to properly define channel flows. A water district level description of the San Joaquin Valley surface water distribution system is more realistic but still very complex and difficult to construct. For purposes of Valley-wide planning it is probably best to use a still more aggregated network which describes deliveries to the Detailed Analysis Units (DAUs) defined by the Department of Water Resources and briefly discussed in Section 1. In this case, the SWAM surface water simulation is concerned only with the total consumption of water within the boundaries of a given DAU. Allocations of water to individual districts or water agencies contained in the DAU are not considered. If more local allocations are of interest to a particular user, the DAU in question may be subdivided into individual districts, provided that the required diversion data are available.

A DAU-level SWAM network describing surface water allocations within the San Joaquin Valley is shown in Figure 3-2. Each channel is shown as a single solid line (regardless of channel type) and is assigned an identification number. Water flowing in the network originates either from upstream reservoirs, from the California aqueduct, or from the Delta-Mendota canal. Most surface water is conveyed to the Valley's 32 DAUs (indicated by numbered ellipses) where it is used for various purposes, including irrigation. A relatively small amount of water can be lost to the Tulare Lake basin. Water can

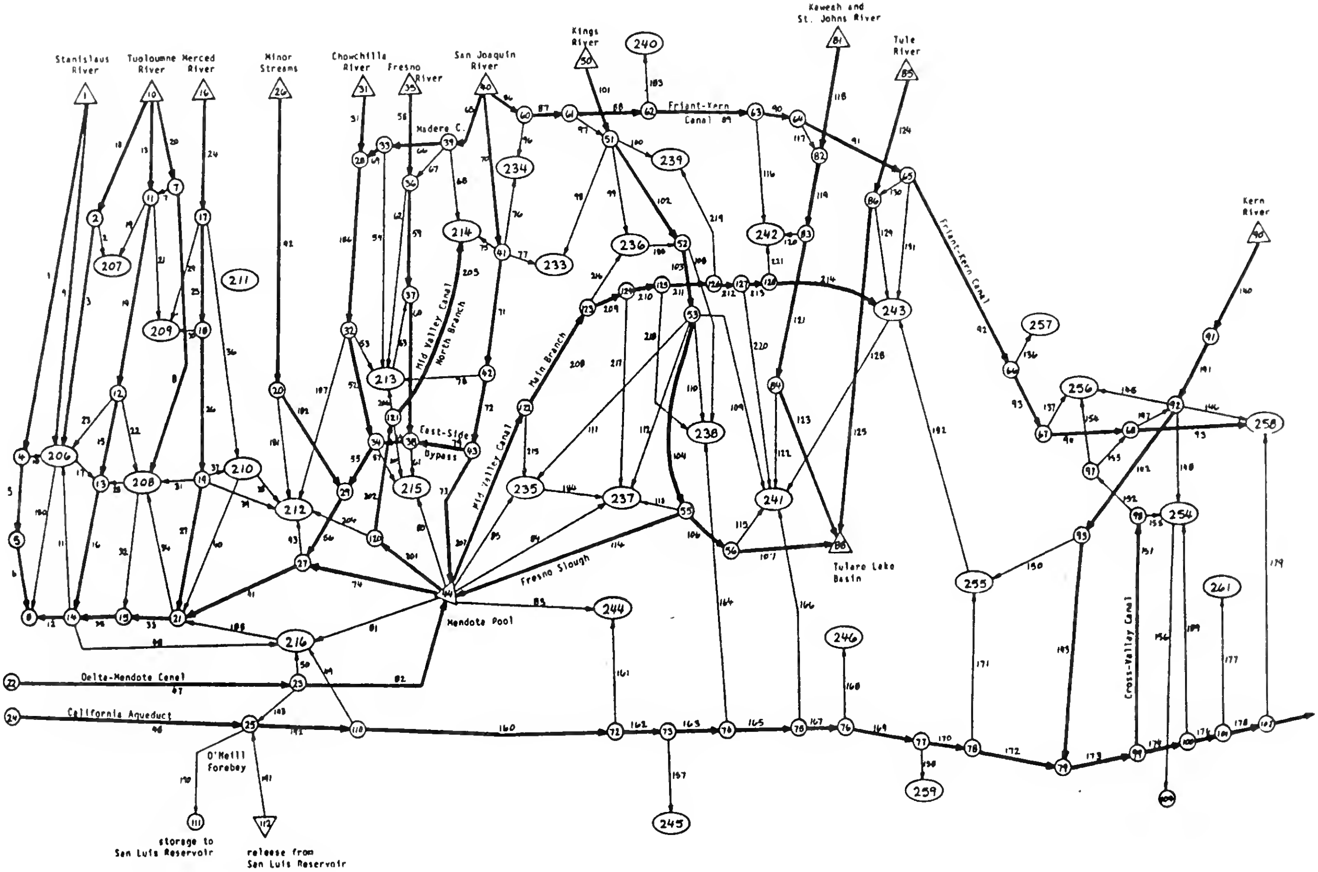


FIGURE 3-2

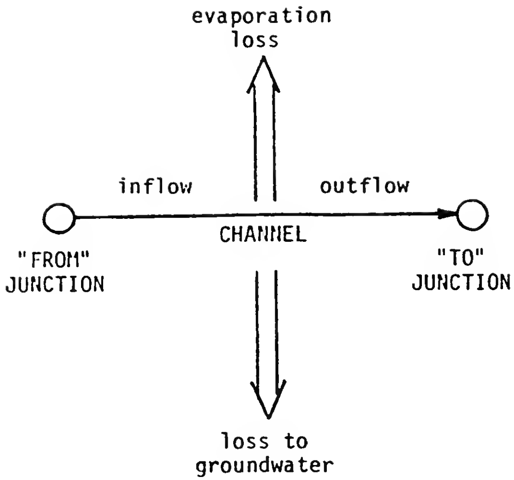
SWAM SAN JOAQUIN VALLEY WATER DISTRIBUTION NETWORK

also leave the system at the southern end (via the California aqueduct) or the northern end (via the San Joaquin River). The small numbered circles shown throughout the system are non-demand junctions.

SWAM's analysis of surface water allocations in the San Joaquin Valley is based on three distinct types of water budgets for channels, demand junctions, and non-demand junctions, respectively. Each channel or junction water budget includes several known inflows, outflows, losses, and demands and one unknown which may be derived by requiring that the algebraic sum of all supplies and demands equal zero. SWAM works through the distribution network channel by channel and junction by junction, solving each budget until all unknown supplies and demands are computed. Diagrams illustrating water budgets for typical channels and junctions are shown in Figures 3-3 through 3-5.

The channel water budget illustrated in Figure 3-3 is relatively simple. The known variables in this case are the channel inflow and evaporation and channel losses. The unknown channel outflow is obtained by subtracting the losses from the inflow. The demand junction water budget illustrated in Figure 3-4 is considerably more complex. The unknown in this case is groundwater pumpage, which is one component of the total supply. The remainder of the supply comes from precipitation and known surface diversions. The total demand includes exports, seepage losses, consumptive use from agriculture, municipal and industrial activities, and wildlife maintenance and intentional recharge. The unknown pumpage is derived by subtracting the total non-pumped supply from total demand. The non-demand junction water budget illustrated in Figure 3-5 provides the link between channel and DAU water budgets. The outflows from all upstream channels converging on a non-demand junction define the junction supply. The unknown is the inflow to the downstream main channel (if any) originating at the junction. This is derived by subtracting all diversions from the total junction supply. A detailed discussion of SWAM's water budget calculations is provided in McLaughlin (1982).

The output from the SWAM program is a complete time history of each of the water supply or demand variables included in the channel and junction water budgets. Of particular interest are the annual groundwater pumpage and recharge rates computed in the demand junction (DAU) water budgets. These rates are important inputs to the other sub-models included in the San Joaquin Hydrologic-Economic Model system (see Section 1.6). Readers interested in a user-oriented description of the SWAM computer code should refer to the SWAM user's manual (McLaughlin, 1982a).



INFLOW - LOSSES - OUTFLOW = 0

FIGURE 3-3

CHANNEL WATER BUDGET

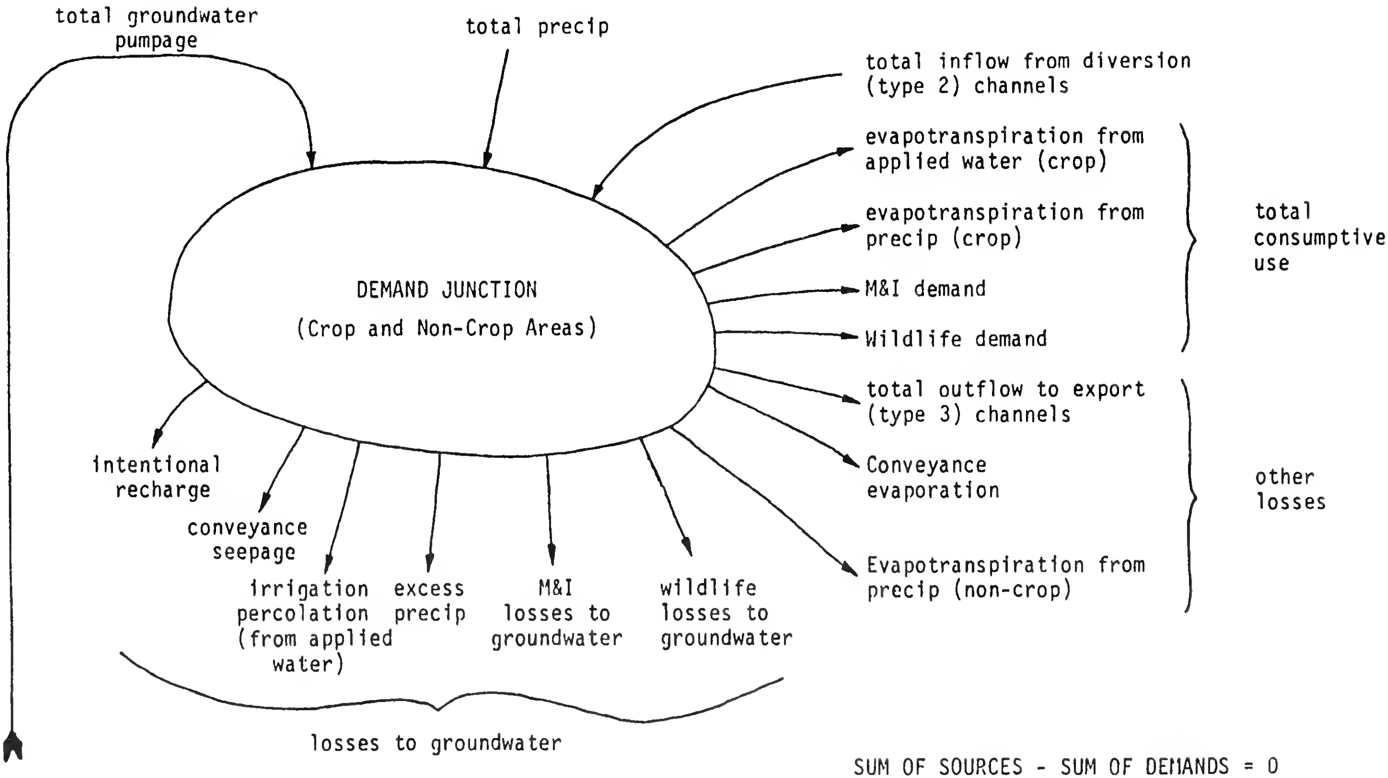
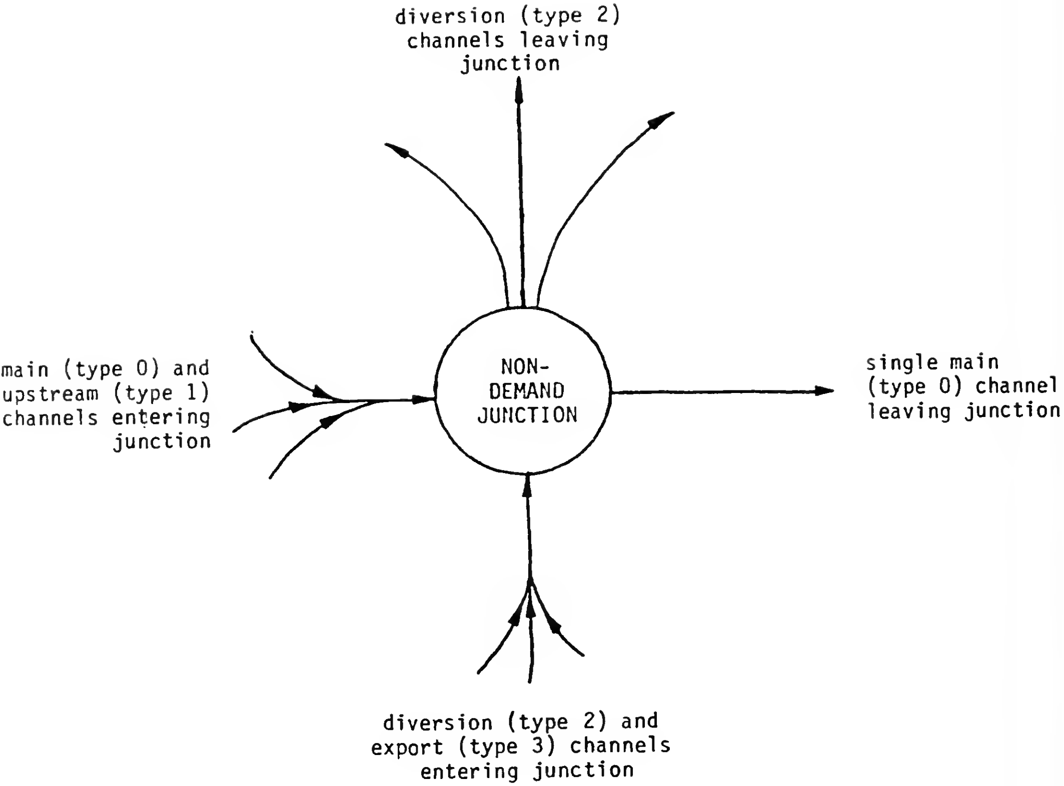


FIGURE 3-4

DEMAND JUNCTION WATER BUDGET



SUM OF INFLOWS - SUM OF OUTFLOWS = 0

FIGURE 3-5

NON-DEMAND JUNCTION
WATER BUDGET

3.1.2 PRACTICAL APPLICATION OF SWAM

The inputs required to run SWAM can be supplied in a variety of ways, depending on the application. The options and data requirements of SWAM are concisely summarized in Tables 3-1 and 3-2. The data requirements are grouped by categories which are convenient for computerized input. Each category listed in Table 3-2 corresponds to one of the "Input Types" included in the main SWAM input file. An example of a typical SWAM input file for the San Joaquin Valley surface water system is presented in Appendix A. This file contains all inputs needed to simulate surface water allocations over the 1970-1977 base period. A detailed discussion of the base period simulation is provided in Section 3.3.

TABLE 3-1

SUMMARY OF SWAM SIMULATION OPTIONS

OPTION	DESCRIPTION OF ALTERNATIVES
1. ETAW Computation	a. The UETAW is specified by the user for each crop in each DAU. b. The UETAW is computed from specified UET for each crop in each DAU and either specified or computed effective precipitation for each DAU and year (see Option 2).
2. Effective Precipitation Option	a. The effective precipitation is specified by the user for each DAU and year. b. The effective precipitation is computed from specified total precipitation for each DAU and year according to the formula in Section 2.2.2.
3. Channel Loss Computations	a. Channel evaporation and recharge losses are computed as specified fractions of upstream channel flow. b. Channel evaporation and recharge losses are computed as the product of a specified per-unit-length loss coefficient (in thousands of acre feet/mile) and a specified channel length (in miles).
4. Intentional Recharge Option	a. Intentional recharge is specified by the user for each year and each DAU. b. Intentional recharge is computed as a specified fraction of total DAU surface water deliveries.
5. M&I/Wildlife Consumptive Use Option	a. Time-varying M&I and wildlife consumptive use requirements are specified by the user for each year and each DAU. b. Time-invariant M&I and wildlife consumptive use requirements are specified by DAU. c. M&I consumptive use requirements are computed by DAU as the product of a specified per capita use rate (in thousands of acre feet/thousand population) and a time-varying population estimate. The population estimates are linearly interpolated from census year populations specified by the user for each DAU. The wildlife consumptive use requirements are assigned user-specified time-invariant values as in Alternative b.

TABLE 3-1
(continued)

OPTION	DESCRIPTION OF ALTERNATIVES
6. Diversion Computations	The user may provide a diversion curve for computing upstream flows in any Type 2 (diversion) or Type 3 (export) channel. If no such curve is provided, the flow for the diversion or export channel must be specified for every year in the simulation period.

TABLE 3-2

SUMMARY OF SWAM DATA REQUIREMENTS

Note: Requirements for any particular application demand on the users choice of simulation options (see Table 3-1)

DATA CATEGORY	DATA REQUIREMENTS
1. Title	A one-line title is needed to identify the simulation run.
2. Options and file units	Flags and file (or tape) unit numbers are needed to identify Table 3-1 options and input-output devices selected.
3. Conversion coefficients	A set of unit conversion coefficients is needed to convert the users units into the program's internal units. The internal units are: Area: thousands of acres Precipitation: feet/year Channel flows: thousands of acre-feet Diversion curves: thousands of acre-feet Consumptive use rates: thousands of acre-feet/year Channel lengths: miles UET and UETAW: feet/year Efficiencies and loss rates: unitless fractions between 0.0 and 1.0
4. Universal coefficients	Coefficients needed include the initial and final years of simulation, the initial and final population census years, the effective precipitation fraction and threshold, the excess precipitation fraction and threshold, and the M&I and wildlife efficiencies.
5. Channel data	The channel-related data needed include the junction numbers at either end of each channel, the channel length, evaporation rate, recharge rate, and channel type.
6. Diversion data	If a diversion curve is selected for a particular channel, the diversion and upstream flows for each breakpoint on the curve are needed.

TABLE 3-2
(continued)

DATA CATEGORY	DATA REQUIREMENTS
7. DAU data	The DAU-related data needed includes DAU area, small conveyance evaporation, recharge rates, M&I and wildlife consumptive use rates, intentional recharge rates, and census year populations.
8. Land use data	Two survey year crop acreages are required for each crop type identified in each DAU. UET, UETAW and irrigation efficiencies are also required for each crop type.
9. Crop codes	A brief 8 letter name is needed to identify each crop type.
10. DAU hydrologic data	Annual precipitation and (optionally) intentional recharge, M&I consumptive use, wildlife consumptive use, and effective precipitation are required for each DAU.
11. Channel flow data	Annual flows are required for each upstream (Type 1) channel and for each diversion (Type 2) or export (Type 3) channel which does not have a diversion curve.

An inspection of Table 3-1 reveals that the SWAM user must perform several distinct tasks before he can carry out a complete simulation:

1. First, the user should draw a diagram of the surface water distribution system to be simulated and specify the type and identification number of each channel and junction. The detail and structure of this network should be compatible with available sources of data on surface water diversions, land use, and other SWAM inputs.

2. Second, the user should lay out the boundaries of the distribution system demand junction (DAUs) on a detailed land use map and he should estimate the acreages devoted to each major crop type near the beginning and end of the simulation period.

3. Third, the user should identify the stream gages and precipitation gages to be used to estimate channel inflows, surface diversions, and DAU average precipitations. Where gages are not available, diversions must be estimated in other ways, perhaps from irrigation district records.

4. Fourth, the user should use historical data to construct curves for computing surface diversions, where this approach is desirable.

5. Fifth, the user should select the desired simulation options regarding computation of ETAW, channel losses, etc. and he should specify the required coefficients by channel, DAU, crop, as appropriate.

6. Sixth, the user should compile historical streamflow data for all source channels and precipitation, effective precipitation and/or intentional recharge data for all DAUs, if SWAM is to be used to simulate hydrologic conditions over a historical period. If SWAM is to be used to investigate hypothetical hydrologic conditions, these time-varying inputs must be postulated or generated synthetically.

All of these steps were carried out during the preparation of the base period simulation discussed in Section 3-3.

3.2 THE SAN JOAQUIN GROUNDWATER MODEL

3.2.1. GENERAL DESCRIPTION OF GWM

The San Joaquin Groundwater Model (GWM) is designed to predict changes in hydraulic head, pumping lift and groundwater storage. When used with a post-processing program called FLUX, this model can also predict subsurface fluxes across specified lines within the groundwater basin. If desired, GWM may be used to generate the pumpage, recharge and lift sequences needed to estimate the equations of motion of the Linear Quadratic Control Model (LQCM). Interactions between GWM and other models in the HEM system are discussed in Chapter 2.

The geology of the San Joaquin groundwater basin is complex when considered in detail but when the basin is viewed as a single large unit it is composed, for all practical purposes, of four layers:

- An unsaturated layer lying between the ground surface and the water table

- An unconfined saturated layer

- A leaky, low-conductivity, saturated confining layer (or aquitard)

- A confined saturated layer lying below the aquitard

The unconfined and confined layers are the two major aquifers (water yielding formations) of the groundwater basin. Each of the four layers mentioned above is portrayed schematically in Figure 3-6, which shows a typical east-west cross section through the Valley. Note that the aquitard does not cover the entire groundwater basin but tapers out near the basin boundaries. This allows significant vertical interaction between the confined and unconfined layers.

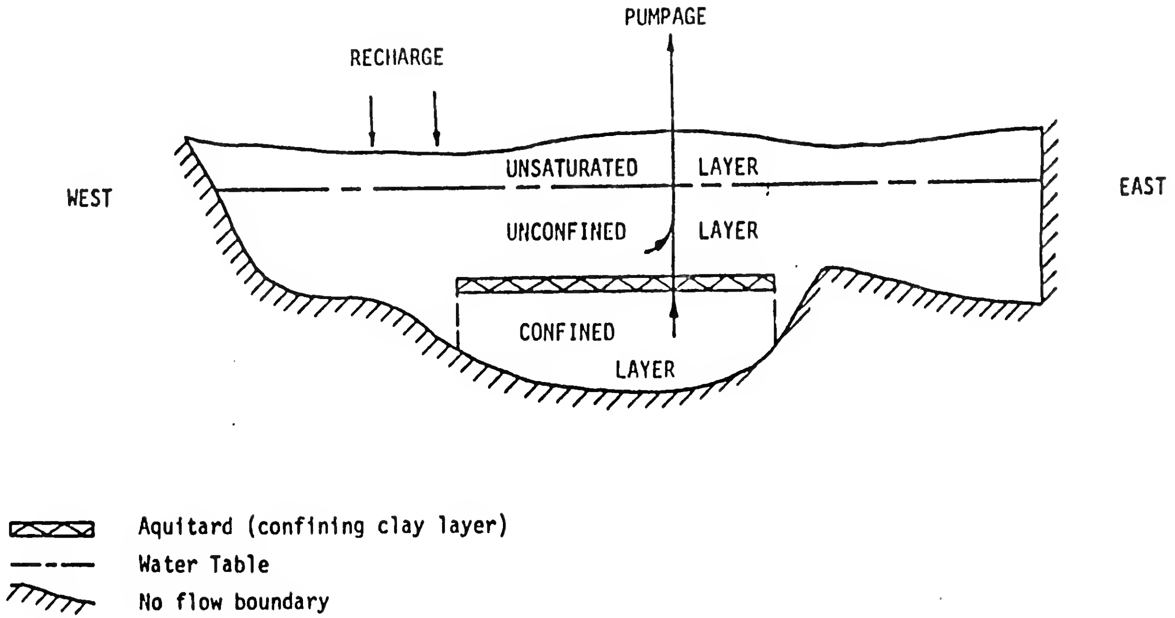


FIGURE 3-6

TYPICAL CROSS-SECTION OF THE
SAN JOAQUIN VALLEY GROUNDWATER BASIN

The primary concern of the San Joaquin Valley groundwater modeling effort is with the basin's two main aquifers. The unsaturated and confining layers are of interest only because of their influence on the movement of water into or out of these aquifers. When viewed from this perspective, the unsaturated layer has two effects which deserve to be included in the groundwater model -- the delay in recharge which occurs as water moves downward from the surface to the water table and the loss of recharge water which goes to satisfy moisture deficiencies in very dry soils. The length of the recharge delay depends on soil characteristics as well as on the depth-to-water at a particular recharge site. If the recharge delay is to be incorporated into the groundwater, model it must be approximated as an integral number of model time steps. Since the model normally uses six-month time steps this implies that the available delay alternatives are zero months, six months, twelve months, etc. Simulation experiments show that a uniform six month (single time step) delay is a reasonably good compromise which gives acceptable results in most of the Valley.

The role of unsaturated zone moisture deficiency may be described with a simple accounting procedure which keeps track of the amount of moisture deficiency satisfied in a given area over a specified simulation period. Recharge in the affected area is suspended until the entire moisture deficit has been satisfied. At this time, water is allowed to move downward with the usual six-month delay.

Examination of available geologic and hydrologic data for the San Joaquin basin indicates that groundwater flow in the unconfined and confined aquifers is predominantly horizontal, while flow in the aquitard is primarily vertical. Horizontal head gradients within the two aquifers are generally of orders of magnitude greater than vertical gradients. It is reasonable, therefore, to approximate the unconfined and confined aquifers as two-dimensional vertically homogeneous aquifers with all flow and head variations limited to the horizontal plane. The aquitard may be approximated as a one-dimensional porous medium which contributes no storage and permits flow only in the vertical direction.

GWM uses a combination of Darcy's Law and the principle of mass conservation

to simulate the interacting leaky aquifer system described above. The hydraulic head in each of the two aquifers is described by a partial differential equation which relates storage change in an infinitesimal region of the aquifer to the net infow of water from adjacent regions. The two aquifer equations are coupled by a leakage term which determines the amount of vertical flow (either upwards or downwards) through the aquitard. The aquifer equations depend on a number of time-invariant physical parameters which describe soil properties and aquifer geometry. These include the unconfined aquifer's specific yield, the horizonal hydraulic conductivity in each aquifer, the confined aquifer's storage coefficient, and the elevations of the top and bottom of each aquifer. The equations also include type-varying "source terms" which contribute to the overall water balance. These account for pumpage and recharge as well as the contribution of aquitard water released by subsidence.

Partial differential equations such as those used in GWM must be solved numerically when applied to groundwater basins as large and complex as the San Joaquin. Available numerical methods include the link-node approach used in DWR's Kern County study (Swanson et al., 1977), the finite difference approach used in the U.S. Geological Survey's Central Valley Aquifer Study (USGS, 1982), and the finite element approach (Pinder and Gray, 1977). GWM uses a finite element numerical solution procedure because this approach is particularly well suited to the irregular DAU and basin boundaries of the San Joaquin Valley. It also provides a convenient way to compute spatially averaged heads at several different levels of aggregation.

The GWM finite element procedure solves the partial differential equations mentioned above by assuming that the head can be described by a continuous surface which extends throughout the entire aquifer (either confined or unconfined). The head surface is divided into many small pieces, each covering a three- or four-sided area called an element. The head surface for a typical two-dimensional, four-sided GWM element is shown in Figure 3-7. The shape of this quadratic surface depends on the head values at each of eight points (called nodes) located at the corners and midsides of the element sides. If the groundwater basin is divided into many elements, with many accompanying nodes, the resulting basin-wide surface can be very complex.

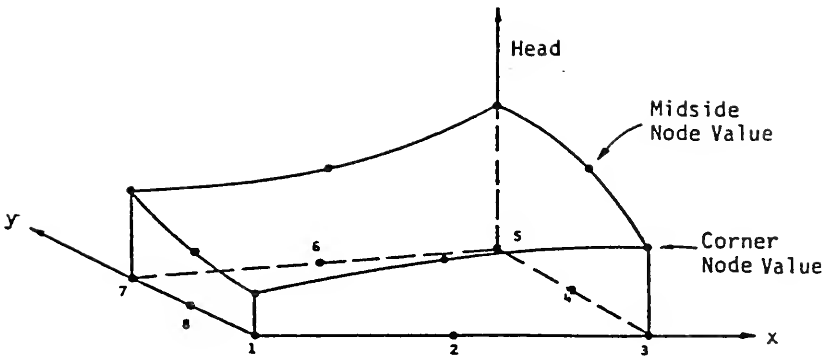


FIGURE 3-7

THE CONTINUOUS HEAD SURFACE FOR
A TYPICAL FOUR-SIDED ELEMENT

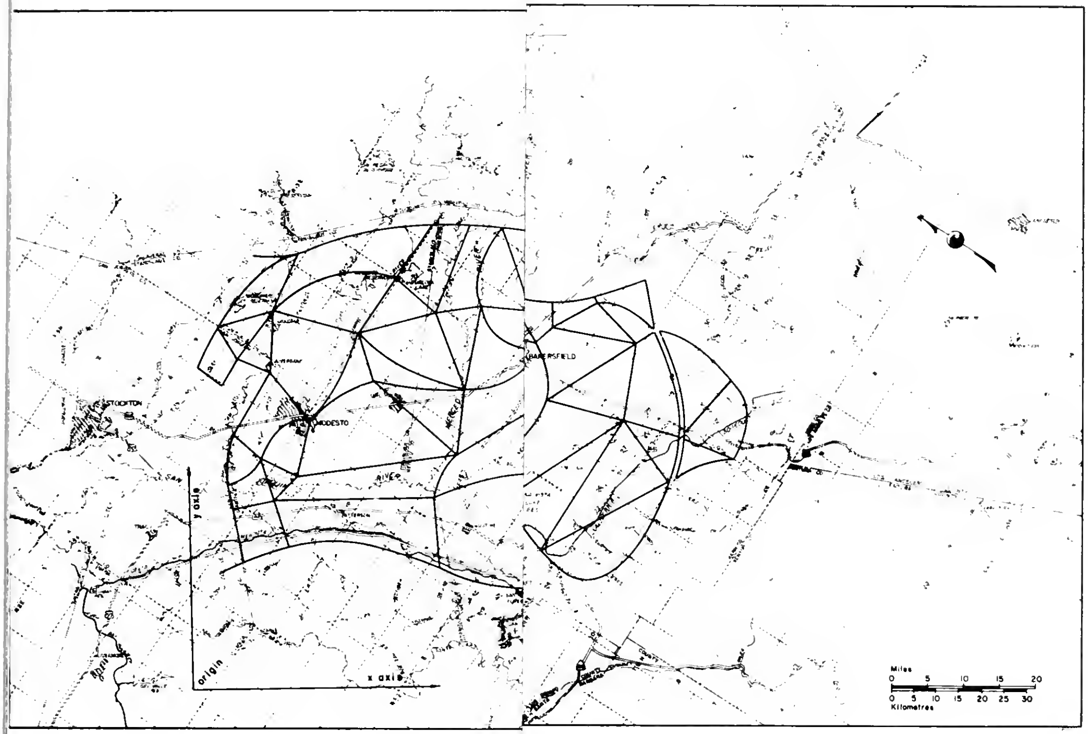
The finite element procedure derives the nodal head which gives the head surface which comes the closest to solving the governing equation throughout the basin. As the basin's elements are made smaller and more numerous the head surface can be brought closer and closer to the exact solution. Of course, if the elements become very numerous the computational cost of the numerical simulation rises sharply. Consequently, the network of elements used in a particular application is inevitably a compromise between accuracy and cost. This is true of any numerical solution procedure, including the link-node and finite difference methods.

The GWM finite element network used for the San Joaquin Valley groundwater modeling study is shown in Figure 3-8. This network has 217 elements and 637 nodes in both the confined and unconfined aquifers. The network elements were designed to meet several different constraints simultaneously. In order to understand these constraints, it is useful to note that GWM's inputs can be entered at four distinct levels of aggregation. Some inputs (such as initial heads and stratigraphic elevations) are entered for each node. Other inputs (such as material properties and subsidence rates) are more conveniently entered for each element. Still other inputs (such as pumpage and recharge rates) are provided for each DAU. Finally, stream recharge rates are entered for each line of element sides lying below a particular surface water channel. When all of these factors are considered in the San Joaquin application, the following constraints result:

1. The network elements must be small enough to provide a sufficiently accurate solution to the governing equations.

2. The network's boundaries should conform reasonably well to the geological boundaries of the groundwater basin.

3. Each San Joaquin Valley DAU should be represented by an integral number of elements.



STOCKTON
MODESTO
BAKERSFIELD
RIVER
y axis
x axis
origin
Miles
0 5 10 15 20
0 5 10 15 20 25 30
Kilometres

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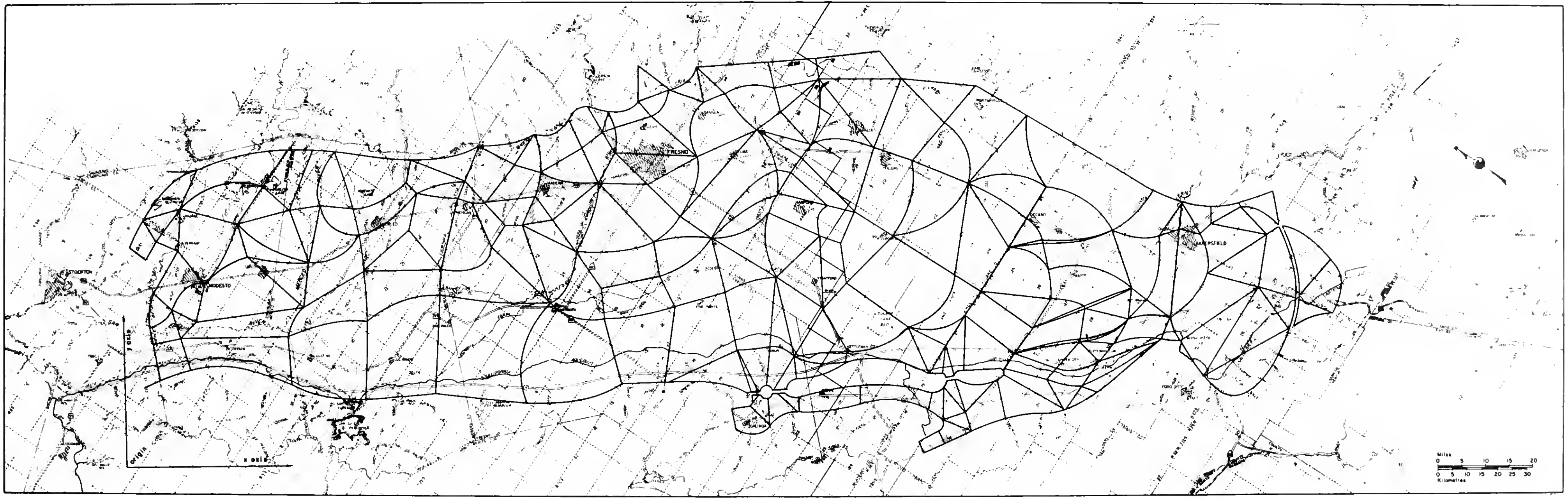
FIGURE 3-8 NETWORK ON BASE MAP



4. Each unlined surface water channel included in the SWAM surface water distribution network should be represented by a line of element sides.

5. The groundwater network should be sufficiently detailed to account for regional variations in land use, soil properties, moisture deficiency, and subsidence as well as for structural anomalies such as geological folds or faults.

6. The number of nodes and elements should be small enough to insure that the cost of a typical simulation is acceptable.

7. Each network node must be exclusively either a corner or a midslide node. It cannot be a corner node in one element and a midside node in another element.

The network of Figure 3-8 is a compromise which is able to meet all of these constraints reasonably well.

The layered finite element simulation procedure used in GWM assumes that both aquifers cover the entire groundwater network. In reality, the confining clay aquitard and, consequently, the confined aquifer only extend over a portion of the Valley (see Figure 3-9). The groundwater model's multi-layered assumption is necessary because the transition which occurs at the edge of the clay is difficult to handle mathematically if the three-layered system is suddenly changed to a single-layered system. The disappearance of the clay aquitard can still be simulated, however, if the model's confining layer is made very conductive and the model's confined aquifer is made very thin in regions where the basin is entirely unconfined. When the confining layer's vertical hydraulic conductivity is raised sufficiently, the two aquifers become completely coupled and the confined and unconfined heads are nearly identical. The confined and unconfined portions of the San Joaquin Valley groundwater network are distinguished in GWM by the value of the vertical conductivity. Elements with vertical conductivities over 100 ft/yr are presumed to be completely unconfined while elements with vertical conductivities under 100

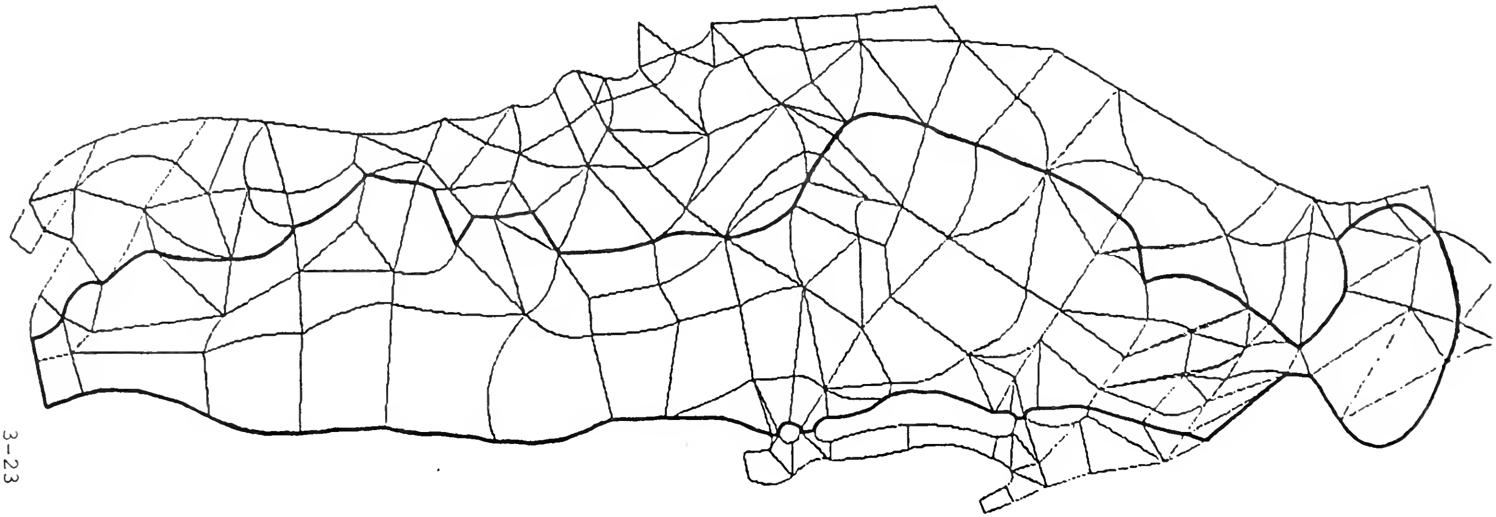


FIGURE 3-9

BOUNDARY OF THE MAJOR CONFINING CLAY LAYER IN
THE SAN JOAQUIN VALLEY GROUNDWATER BASIN

ft/yr are presumed to be multi-layered. The 100 ft/yr threshold is based on model sensitivity studies and may have a different value in other basins.

The finite element discretization procedure converts the governing groundwater equations into a set of coupled simultaneous difference equations (one equation for each node in each aquifer) which are solved recursively through time. Each equation is initialized with the head assumed to apply at its node at the beginning of the simulation period. The equations are then solved for the unknown heads at the end of the first step. This process is repeated for each step in the simulation period. In principle, the GWM time step can be set as small as desired but limitations of data availability and computational cost put practical lower bounds on time step duration. The time step used in SWAM is restricted to one water year, primarily because of the difficulty in obtaining surface diversion and consumptive use data on a finer time scale. Since SWAM provides pumpage and recharge information to GWM on an annual schedule, these inputs must be allocated through time if the GWM time step is less than one year. Semi-annual temporal allocations are feasible since most of the contributors to SWAM's recharge and pumpage can be readily assigned to either the summer or winter period. Shorter GWM time steps would be difficult to support without the available data base. The six-month time step is particularly convenient since it allows the model to simulate summer drawdowns, which are of interest for economic reasons, as well as winter highs, which are of interest because they can be compared to reliable winter measurements.

The primary output from the GWM program is a complete time history of the confined and unconfined heads at each network node as well as histories of the heads averaged over each element and each DAU. GWM also computes and reports the change in storage, total subsidence, and total loss to moisture deficiency at each time step (relative to the initial time). Computer files generated by GWM provide all the information needed to derive subsurface fluxes in either aquifer. These fluxes may be evaluated with the FLUX program mentioned earlier. User-oriented descriptions of the GWM and FLUX programs are provided in McLaughlin (1982b) and McLaughlin (1982c), respectively.

3.2.2 PRACTICAL APPLICATION OF GWM

The inputs required to run the GWM program can be supplied in a variety of ways, depending on the application. GWM's available options and data requirements are summarized in Tables 3-3 and 3-4. The data requirements are grouped by categories which are convenient for computerized input -- each category listed in Table 3-4 corresponds to one of the "Input Types" included in the main GWM input file. An example of a typical GWM input file for the San Joaquin Valley groundwater basin is presented in Appendix B. This file contains all inputs needed to simulate groundwater behavior over the period from April 1970 to March 1977. A detailed discussion of this base period simulation is provided in Section 3.3.

All of these steps were carried out during the preparation of the base period simulation discussed in Section 3.3.

3.3 SIMULATION OF HISTORICAL GROUNDWATER CHANGES IN THE SAN JOAQUIN VALLEY

3.3.1 OVERVIEW

Simulation of historical changes in groundwater levels and storage is important for two reasons. First, historical simulations provide a way to evaluate the accuracy and establish the credibility of a simulation model. Second, historical simulations can give a good overall picture of groundwater trends and can identify the reasons for changes observed in the field. The historical simulation of the San Joaquin Valley groundwater basin discussed in this section provides useful information on both model performance and recent trends. Readers should note, however, that this simulation is presented as an example of model capabilities rather than an indisputable assessment of San Joaquin Valley groundwater conditions. The Valley's groundwater basin is too complex and there are too many gaps in available data for any modeling effort to be considered the last word. Although many uncertainties exist about such important phenomena as stream recharge, subsurface boundary flows, moisture deficiency, and comsumptive use, the modeling effort described here is remarkably successful at reproducing historical head observations. This suggests that SWAM and GWM have the capabilities needed to simulate overall

TABLE 3-3

SUMMARY OF GWM SIMULATION OPTIONS

OPTION	DESCRIPTION OF ALTERNATIVES
1. Simulation Option	a. The model is run dynamically over a specified simulation period.
	b. The model is run in steady state (all inputs are assumed to be time-invariant).
	c. The model is used only to average measured heads (supplied at nodes) over both elements and DAUs.
2. Pumpage-Recharge Option	a. The DAU pumpage and recharge for each year are either specified by the user or supplied by SWAM. This alternative is used for normal simulation.
	b. The DAU pumpage and recharge are supplied by a random number generator. This alternative is used in order to provide time sequences for estimation of the LQCM equations of motion (see Section 1.2).
3. Initial Condition Option	a. A single common initial head value is applied to all network nodes in each aquifer.
	b. A distinct head value is specified for each node in each aquifer. This is the alternative normally used.
4. Material Scale Factor Option	a. Material scale factors are not used or read.
	b. Material scale factors are used. These scale factors simultaneously scale all material properties in a particular material group defined by the user. This alternative is useful during model calibration but it not needed during normal simulation.
5. Surface Water Input Option	a. Annual DAU pumpage and recharge values are specified by the user.
	b. Pumpage and recharge values are supplied by SWAM.
6. Geometric Input Option	a. Node and element data describing groundwater network geometry are specified by the user.

TABLE 3-3
(continued)

OPTION	DESCRIPTION OF ALTERNATIVES
	b. Node and element data describing network geometry are supplied by a preprocessing program called RMA1. If this alternative is selected the elements need not be re-ordered in GWM.
7. Element Reordering	a. The GWM equation solver assembles element equations in numerical order or, if geometric data are obtained from RMA1, in the order derived in RMA1.
	b. The GWM equation solver assembles element equations in an order specified by the user.
8. Element Allocation Computation	The user may optionally specify fractions which allocate percentages of DAU pumpage and recharge to particular elements and to the two aquifers. If this option is not exercised allocation is based on the ratio of element area to DAU area.

TABLE 3-4

SUMMARY OF GWM DATA REQUIREMENTS

Note: Requirements for any particular application demand on the users choice of simulation options (see Table 3-3)

DATA CATEGORY	DATA REQUIREMENTS
1. Title	A one-line title is needed to identify the simulation run.
2. Options and file units	Flags and file (or tape) units numbers are needed to identify Table 3-1 options and input-output devices selected.
3. Time controls	Inputs are needed to specify the initial year of simulation, the time step (normally 0.5 years), and the number of solution iterations for each time step.
4. Scale factors	Coordinates are needed to specify the portion of the network to be included in the simulation. Normally, the entire network is included. Also, scale factors are needed to relate map scale coordinates of the network diagram to distances in the real groundwater basin.
5. Element geometry	The identification numbers of each node associated with a particular element are needed to define the geometric properties of the groundwater simulation network.
6. Node geometry data	The node-related geometry data needed includes the X and Y coordinates in map units and the elevations (in feet above mean sea level) of the top and bottom of each aquifer.
7. Channel data	A table relating element midside node to channel identification numbers is needed to identify the element sides lying under each SWAM recharge channel.
8. Initial conditions	Initial confined and unconfined head values are required for every network node unless the uniform head option is selected.

TABLE 3-4
(continued)

DATA CATEGORY	DATA REQUIREMENTS
9. Element solution order	If the reordering option is selected, the user must specify the order in which the element equations are to be solved.
10. Specified head and/or flux values	Either the head or sub-surface flux is required at each basin boundary node in each aquifer in order to properly define the model's boundary conditions. The default boundary condition is zero flux. If a non-zero flux or head is specified by the user the default is overridden.
11. Material properties	Values are needed for the confined and unconfined specific yields, confined and unconfined hydraulic conductivities, confined storage coefficient, aquitard vertical conductivity, and material property group of each network element.
12. Material scale factors	If the material scale factor option is selected, a scale factor is needed for each material property in each group of elements identified by the user.
13. DAU-element data	A table giving the identification numbers of the elements in each DAU is needed to relate DAU and element level data.
14. DAU source data	Several coefficients are required to convert the user's pumpage-recharge and area units into the programs internal units. The internal units are: Volume: cubic feet Area: square feet Distance: feet Pumpage, recharge and other fluxes: ft/yr Hydraulic conductivities: ft/yr Storage coefficient and specific yields: unitless fractions between 0.0 and 1.0 An additional coefficient is needed to define the percentage of annual pumpage occuring during the summer (April-September) time step.
15. Element allocation data	Allocation coefficients for assigning DAU pumpage and recharge to specific elements may be provided if desired.

TABLE 3-4
(continued)

DATA CATEGORY	DATA REQUIREMENTS
16. Subsidence and moisture deficiency data	Values are required for the subsidence rate, the subsidence head threshold, the fraction of element area with moisture deficient soil, and the initial moisture deficit in each element with either subsidence or moisture deficiency.
17. Pumpage and recharge data	The pumpage and recharge are required for each DAU and each water year in the simulation period. This information is normally supplied by SWAM but may be specified independently by the user, if desired.

trends in Valley hydrology. If the data base is improved, model predictions will probably be even better.

The selection of a historical period for the model base period simulation was governed primarily by the ready availability of surface water and hydraulic head data. The San Joaquin district office of DWR completed a large data compilation effort for the period 1970-1975 water years just before the modeling phase of the San Joaquin Valley groundwater study was started. Many of the results of this data compilation effort are summarized in the two volumes of DWR Bulletin 160-82 (DWR, 1980b, and DWR, 1981b). At about the same time, DWR obtained a large set of San Joaquin Valley water level records for the period 1970-1980. These records were compiled by the USGS as part of its Central Valley Aquifer Study (USGS, 1982). The combination of Bulletin 160-82 and water level data compiled by DWR provided a good data base for the period including the 1970-1975 water years. With some additional effort this data base was extended to the period including the 1970-1977 water years.

The 1970-1977 water year period is of interest for several reasons other than the convenient availability of data. At the beginning of this period, state and federal surface water deliveries from the California Aqueduct were just beginning to have an effect on the San Joaquin Valley. There was a severe groundwater depression in the western section of Westlands and other areas still to be served by the aqueduct. The groundwater situation in the aqueduct service area changed dramatically during the early seventies, particularly in the Westlands where confined groundwater levels rose hundreds of feet. The groundwater overdraft was further mitigated by an unusually wet 1973 water year. This was followed by two relatively normal water years and then by the severe 1976-1977 water year drought. Overall, the 1970-1977 period is one of the most interesting eight-year hydrologic periods in recent history.

The detailed timing of the base period simulation is very dependent on the availability of reliable water level data for initializing the groundwater model. Generally speaking, winter and early spring water level measurements are much better indications of regional head gradients than those taken in the summer or fall. Summer and fall measurements are much more likely to be taken while the well is still recovering from irrigation season pumpage and are also

more likely to be influenced by drawdowns from nearby wells which are still being pumped. For these reasons, a decision was made to start the groundwater simulation in the early spring (April) of 1970 and to compare simulated and measured heads every subsequent spring from 1971 through 1977. In order for the groundwater simulation to be started in April 1970, SWAM must be started with the 1970 water year. This provides the six-month delayed summer recharge and the current summer pumpage needed to simulate the first GWM time step (April 1970 to September 1970). SWAM is run for each subsequent water year through 1977 to provide enough pumpage and recharge data for a GWM simulation ending in March 1977. The relationship between the SWAM and GWM simulation periods is diagrammed in Figure 3-10.

The April 1970 to March 1977 GWM simulation period provides seven times at which measured and simulation results can be compared. This period is, however, inconvenient for the calculation of storage changes and overdraft since the beginning and end points fall in the middle of two SWAM water years. Consequently, the average base period water budget is computed over the period October 1970 to September 1976. This period is also indicated in Figure 3-10.

McLaughlin (1982) describes in detail the data sources used to define model inputs for the eight-year SWAM base period simulation and for the seven-year GWM base period simulation. The remainder of this section describes the results of the base period simulation from two perspectives. Section 3.3.3 discusses measured and simulated head comparisons for the seven winter measurement times. Section 3.3.4 discusses DAU and basin-wide water budgets for the six-year period October 1970 through September 1976. The simulation results presented here represent only a small fraction of the complete set of results generated by SWAM and GWM. Water budgets similar to those described in Section 3.3.4 could also be developed for each GWM element or for any areal units which can be constructed from individual elements. Also, water budgets could be developed for any six-month or one-year simulation interval within the base period. The data necessary for these additional water budget calculations are available in extensive computer outputs which have been furnished to DWR under separate cover.

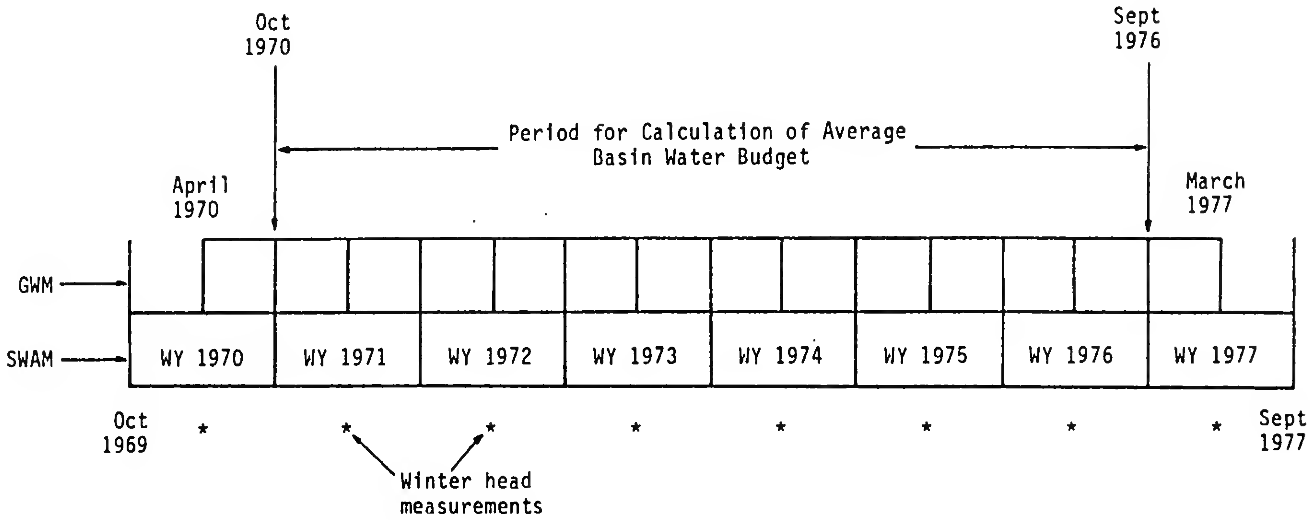


FIGURE 3-10

COMPARISON OF SWAM AND GWM BASE PERIODS
AND TIME STEPS

3.3.2 DESCRIPTION OF THE MODEL CALIBRATION AND VERIFICATION PROCESS

Discussions of groundwater modeling studies often make a distinction between model calibration and model verification. Model calibration generally refers to the process of adjusting poorly known model coefficients (such as hydraulic conductivities or subsidence rates) to obtain a good match between measured and simulated heads over a historical period. Model verification generally refers to the process of testing a calibrated model's ability to predict observed heads. Model coefficients would not be adjusted during verification.

The traditional distinction between model calibration and verification is usually not strictly observed in practical groundwater applications. One of the primary reasons for this is that groundwater data are generally not available in abundant quantities. Hydraulic heads are collected at wells which are scattered throughout a basin and which are not necessarily drilled in the locations best suited for model evaluations. Even when hydraulic head data are relatively abundant, other time-varying inputs such as surface water diversions may not be available over a long enough period to support distinct calibration and verification data sets. The general scarcity of reliable groundwater data tends to force the model builder to use as much data as possible to estimate poorly known coefficients. If some of the data are set aside for model verification, the coefficient estimates will be less accurate and the model's predictive ability will suffer.

In the San Joaquin Valley groundwater modeling application reasonably reliable head data were available over much of the basin but comparisons of simulated and measured heads could be conducted at only seven times (the winters of 1971 through 1977). The small number of available time periods greatly reduced the usefulness of splitting the data set into separate calibration and verification subsets. The data set could have been divided spatially but in this case some important elements and DAU's with a limited number of wells would have been left either without any calibration data or without any verification data.

The various considerations mentioned above suggested that the best approach to model calibration and verification in the San Joaquin Valley application was to avoid a formal split between calibration and verification and, instead, to adjust model coefficients to achieve a reasonable overall fit to the seven years of measured head data. That is, adjustments were not used to achieve near-perfect fits in some years to the detriment of fits in later years. Attention was focused on longer term trends (e.g., reising water levels vs. declining water levels) rather than on anomalies observed in any single year. This type of informal calibration-verification process appears to be the one which best serves the overall objectives of the San Joaquin Valley groundwater study. It is also the one most commonly used in practice.

3.3.3 COMPARISON OF SIMULATED AND MEASURED HYDRAULIC HEADS

As noted in Section 3.2, the GWM program provides simulated heads at each groundwater network node at each time step in the simulation period. It also averages the continuous head distribution generated by the finite element procedure (see Figure 3-7) over each network element and each basin DAU. The element and DAU averages are particularly useful for model comparisons since they are really oriented and less numerous than nodal values. If the simulated heads generated by GWM are to be evaluated at the element or DAU level, a procedure must be devised for synthesizing element or DAU level from individual well observations. These synthetic measurements are actually estimates of the head which would be obtained if observations from a very large number of wells in one element or DAU could be averaged.

A reasonable way to obtain element and DAU level head measurements is to contour well observations throughout those regions where well data are available. The head values at network nodes can then be read off the contour plots and automatically averaged over each element included in the contouring procedure. In the San Joaquin Valley groundwater modeling project, the contoured nodal measurements were automatically computed by a Kriging algorithm (McLaughlin 1982). The wells providing data for the measured head contours were the same ones used to estimate the model's initial heads (see McLaughlin, 1982, for a discussion of the well selection process). All well observations used in the base period model evaluation are listed in Appendices

D and E. It should be noted that the Kriging algorithm does not draw contours or estimate measured nodal heads in regions where well observations are very sparse or widely scattered. In such regions available well data are not adequate for model evaluation purposes.

Element and DAU averages of measured (i.e. Kriged) heads can be computed with the GWM program if the appropriate simulation option is selected (see Table 3-3). When the input flag IMODE is set equal to 2, the program reads in a file of measured node values generated by the Kriging algorithm and computes average confined and unconfined heads for every element and DAU where contours are available. These average measured heads can be directly compared to the average simulated heads computed by the model when IMODE is set equal to 0 (normal dynamic simulation).

The model's ability to reproduce averaged head observations is conveniently summarized in Tables 3-5 and 3-6, which give the mean head difference, mean absolute head difference, and head difference standard deviation (root-mean-square difference) at the element and DAU level for each winter in the 1970-1977 GWM simulation period. The statistical evaluations presented in these tables indicate that the predictive ability of the SWAM-GWM combination lies well within the range of accuracy (several feet) needed to estimate DAU-level well pumping costs and frequently within the range of accuracy to which regional water levels can be measured. The accuracy of the base period simulation results give credibility to the water budget analysis presented in the next subsection as well as to the scenario runs discussed in Chapter 6.

An alternative view of the base period simulation results can be obtained from contour plots of the heads at the beginning and the end of the October 1970 through September 1976 period. These late summer plots, presented in Figures 3-11 through 3-14, show the areas where pumping season drawdowns are most severe. The changes in groundwater conditions over the six-year period are conveniently summarized in Figures 3-15 and 3-16, which are contour plots of the difference between the 1976 and October 1979 heads. Note the dramatic increase in the confined head which occurred along the western edge of the basin, where surface water deliveries from the California Aqueduct reduced the demand on groundwater resources. The plots also show that

TABLE 3-5

STATISTICAL SUMMARY OF ELEMENT LEVEL COMPARISONS
OF SIMULATED AND MEASURED HEADS

NOTES: 1) All head comparisons are made in the late winter
2) Head values are in feet above mean sea level

	WATER YEAR							
	1971	1972	1973	1974	1975	1976	1977	BASE PERIOD AVERAGE
UNCONFINED AQUIFER								
Number of elements compared	149	153	149	149	146	143	139	147
Mean head difference	-2.3	-1.9	-3.1	-3.9	-3.8	-1.7	-2.5	-2.7
Mean absolute head difference 1/	7.7	10.0	12.1	12.4	12.7	13.6	14.7	11.9
Head difference standard deviation	10.0	12.9	16.2	15.4	15.6	17.0	18.6	15.1
CONFINED AQUIFER								
Number of elements compared	78	83	80	79	74	75	78	78
Mean head difference	-1.5	1.2	-0.1	0.7	10.0	17.2	5.4	4.7
Mean absolute head difference	17.6	18.9	15.0	17.7	15.8	21.5	21.7	18.3
Head difference standard deviation	22.0	24.9	19.0	21.6	17.4	21.2	27.0	21.9

1/ mean absolute head difference = observed head - predicted head

TABLE 3-6

STATISTICAL SUMMARY OF DAU LEVEL COMPARISONS
OF SIMULATED AND MEASURED HEADS

NOTES: 1) All head comparisons made in the late winter
2) Head values are in feet above mean sea level

	WATER YEAR							
	1971	1972	1973	1974	1975	1976	1977	BASE PERIOD AVERAGE
UNCONFINED AQUIFER								
Number of DAUs compared	17	17	17	17	17	17	17	17
Mean head difference	-2.2	-1.1	-3.1	-3.1	-2.7	-0.2	-1.1	-1.9
Mean absolute head difference	5.2	5.9	6.0	5.7	5.9	6.9	7.1	6.1
Head difference standard deviation	6.6	6.9	6.4	6.4	6.6	8.6	9.0	7.2
CONFINED AQUIFER								
Number of DAUs compared	7	8	8	8	7	7	6	7
Mean head difference	-9.9	-2.8	4.9	3.9	13.2	22.9	4.7	5.3
Mean absolute head difference	11.8	11.2	14.0	15.9	15.8	24.0	18.3	15.9
Head difference standard deviation	8.7	14.5	19.3	20.6	14.0	15.9	22.5	16.5

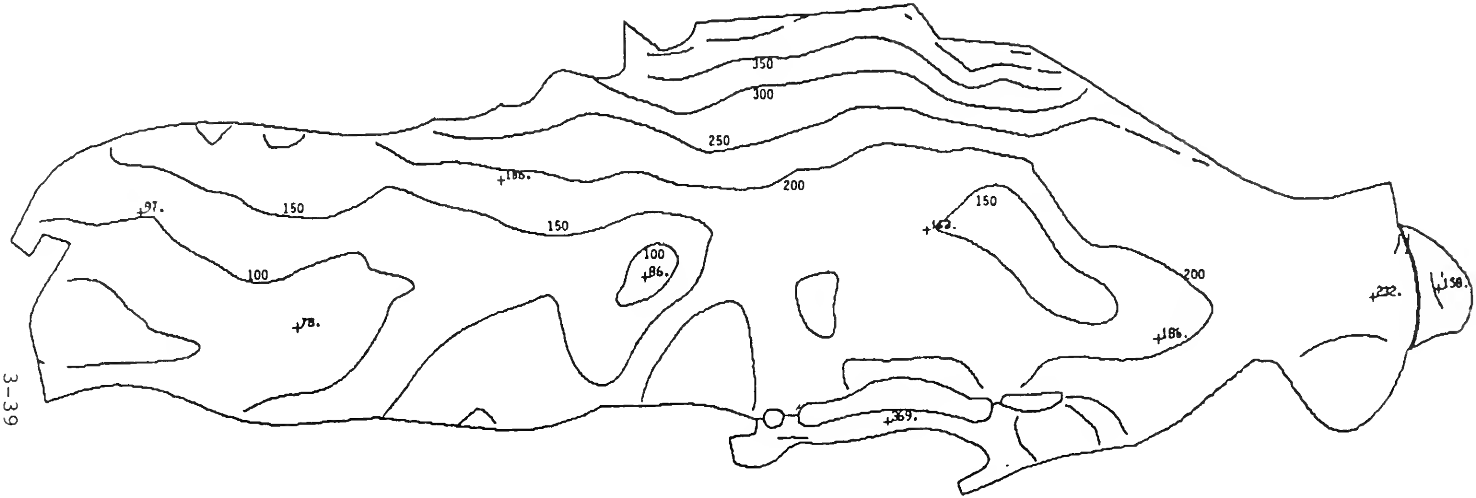


FIGURE 3-11

SIMULATED UNCONFINED HEADS
FOR SEPTEMBER 1970

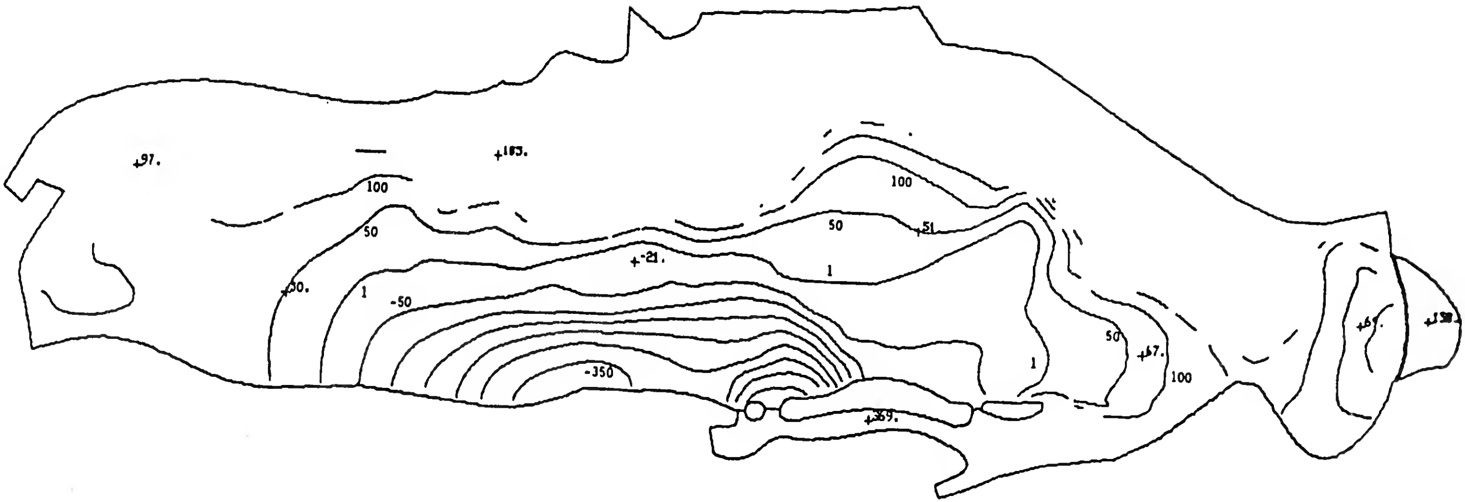


FIGURE 3-12

SIMULATED CONFINED HEADS
FOR SEPTEMBER 1970

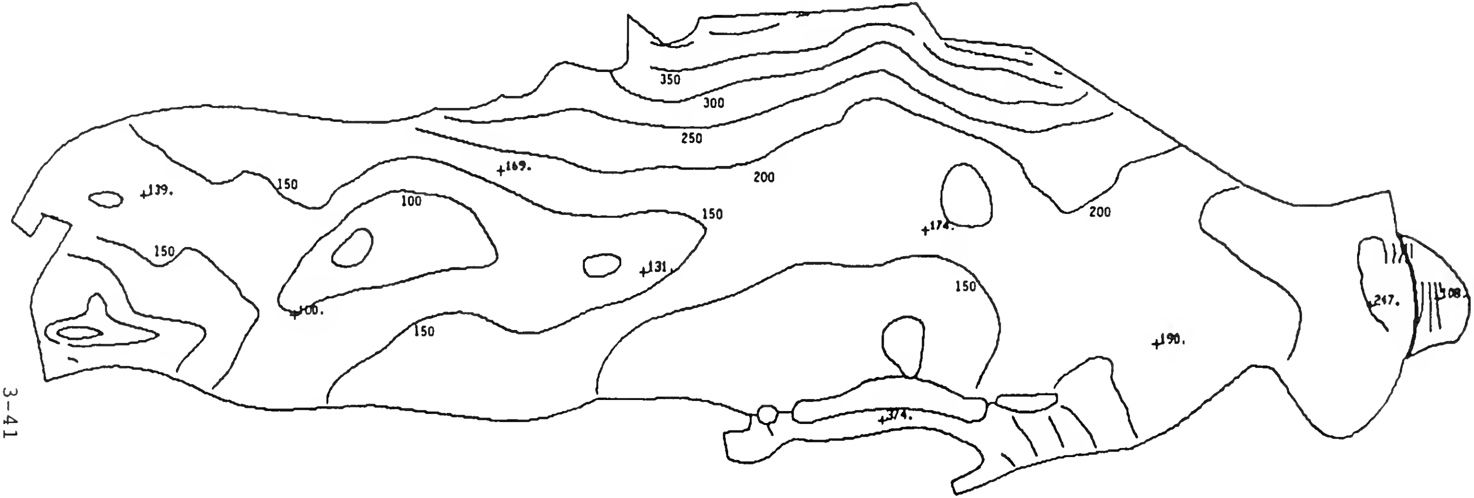


FIGURE 3-13

SIMULATED UNCONFINED HEADS
FOR SEPTEMBER 1976

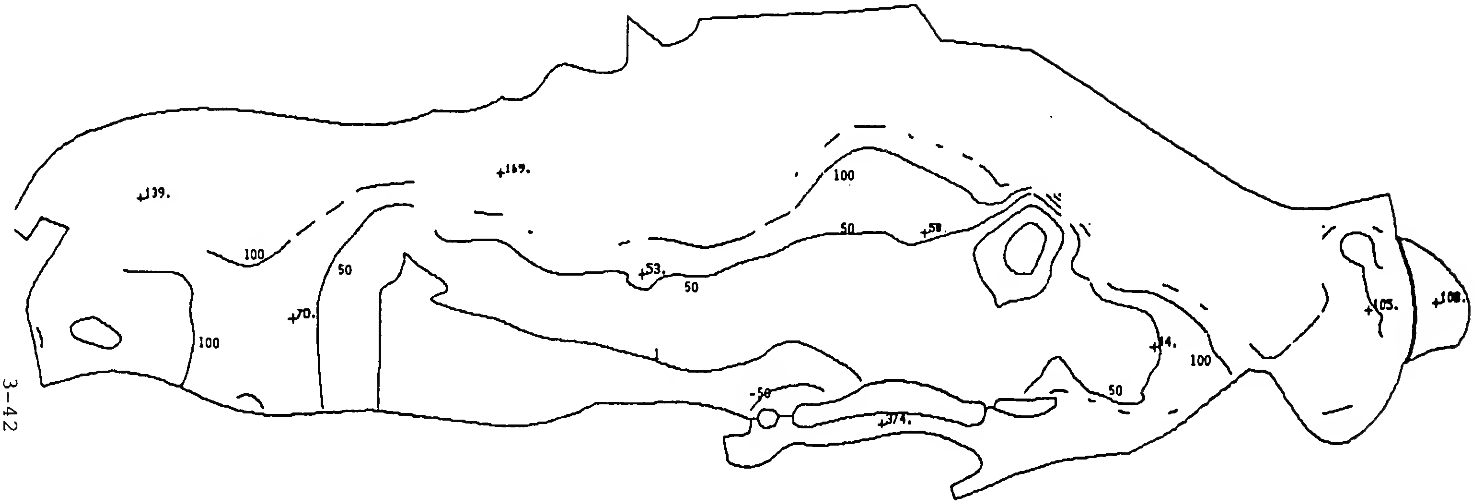


FIGURE 3-14

SIMULATED CONFINED HEADS
FOR SEPTEMBER 1976

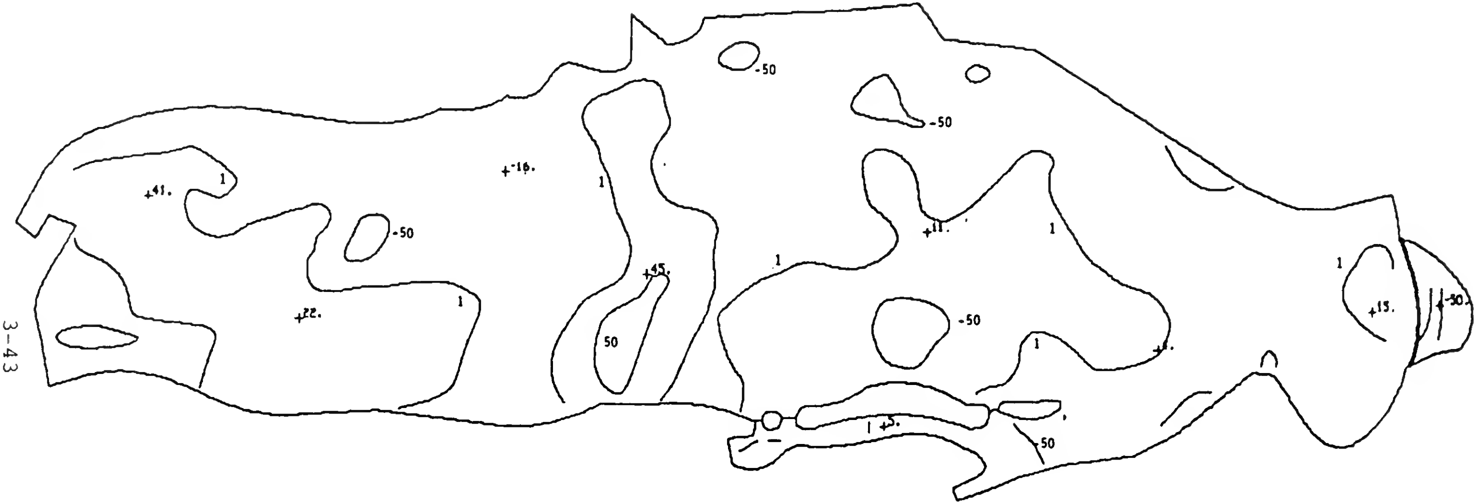


FIGURE 3-15

CHANGE IN SIMULATED UNCONFINED HEADS
FROM SEPTEMBER 1970 TO SEPTEMBER 1976

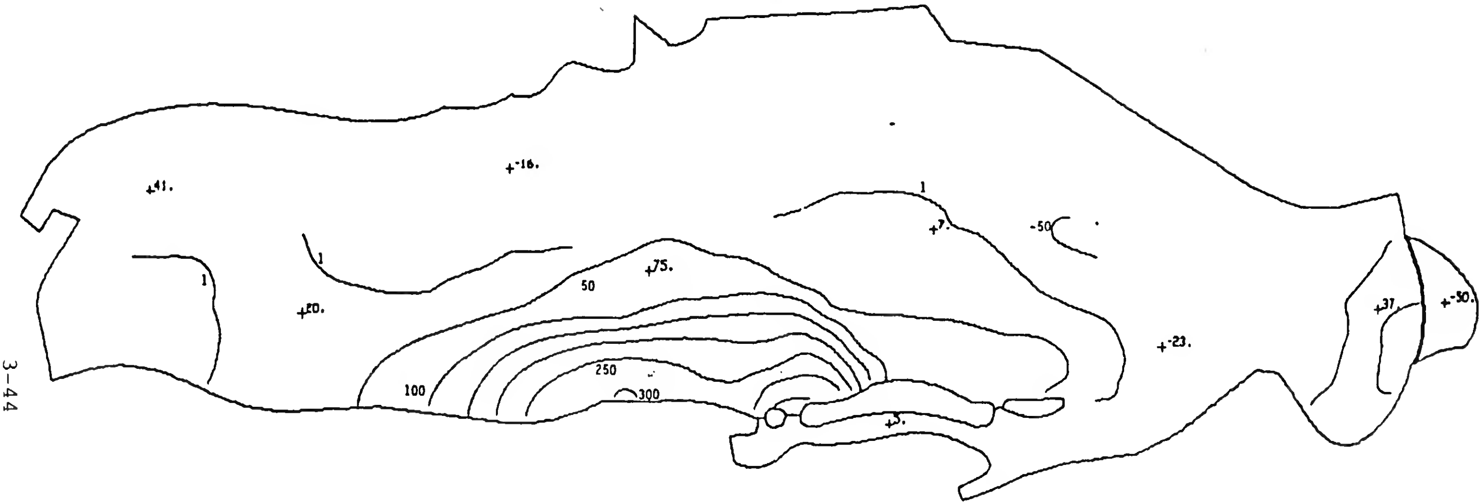


FIGURE 3-16

CHANGE IN SIMULATED CONFINED HEADS
FROM SEPTEMBER 1970 TO SEPTEMBER 1976

unconfined head dropped throughout much of the eastern part of the basin and rose significantly in the Tulare Lake region. The reasons for these head changes can, for the most part, be deduced directly from the supply and demand figures provided in the DAU water budgets of the next subsection.

3.3.4 BASE PERIOD WATER BUDGETS

Although the primary function of the San Joaquin Valley groundwater model is to predict heads and pumping lifts, this model also provides useful information on groundwater storage changes, subsidence rates, losses to moisture-deficient soils, and subsurface fluxes. When this information is combined with supply and demand predictions computed by SWAM a complete surface-subsurface water budget can be constructed at either the DAU or basin level. This water budget gives a balanced picture of the status of the Valley's entire water resource system and provides a means for identifying potential groundwater basin overdrafts.

There are many ways to organize and disaggregate water budgets. A particularly straightforward and informative approach is to retain the distinction between surface and subsurface contributions to supply and demand and to relate these two components of the water budget by including pumpage and recharge in both. All of the items in the surface component of the budget can then be read directly from SWAM output while all of the subsurface budget items can be read from either GWM or FLUX outputs. A list of the supply and demand variables included in the complete San Joaquin water budget is provided in Table 3-7.

A water budget can be constructed for each of the six water years in the October 1970 to September 1976 period identified in Figure 3-10. Although comparisons of these annual budgets can be informative, an average base period budget gives a better overall picture of basin conditions and is much easier to assimilate. This budget, constructed from six-year averages of all supply and demand variables, is presented in Table 3-7. The water budget is, for the most part, self-explanatory, but a few items require clarification. All supply and demand variables except for channel recharge are computed at the DAU level by either SWAM, GWM or FLUX. Channel recharge is computed by SWAM

TABLE 3-7

AVERAGE SIMULATED DAU WATER BUDGETS FOR WATER YEARS 1971-1976 (All quantities in thousands of acre feet)

	DAU															
	206	207	208	209	210	211	212	213	214	215	216	233	234	235	236	237
SURFACE SYSTEM																
SUPPLY																
1. Surface diversions	513	8	631	90	537	0	117	247	5	67	1409	507	11	35	336	225
2. Groundwater pumpage	206	27	199	107	179	54	408	503	152	404	503	423	38	382	422	370
3. Total precipitation	172	136	189	149	143	152	184	142	167	131	509	207	61	106	149	97
4. Supply Subtotal	971	171	1019	346	859	206	709	892	324	602	2421	1137	110	523	907	642
DEMAND																
5. Crop evapotranspiration	374	24	440	132	338	36	317	414	112	290	1071	451	36	228	379	323
6. Non-crop evapotranspiration	68	82	81	85	65	110	116	78	119	94	354	141	34	93	78	79
7. Municipal and industrial consumptive use	27	0	13	0	11	0	0	5	0	0	4	45	0	1	6	1
8. Wildlife consumptive use	0	0	0	0	0	0	11	0	0	0	53	0	0	20	0	0
9. Exports and spills	50	0	87	0	90	0	0	36	0	0	179	0	0	20	22	0
10. DAU conveyance evaporation	10	0	13	2	11	0	2	5	0	1	28	10	0	1	7	5
11. Total recharge to groundwater	434	65	385	127	344	60	263	354	93	217	732	490	40	160	415	234
12. Demand Subtotal	971	171	1019	346	859	206	709	892	324	602	2421	1137	110	523	907	642
GROUNDWATER SYSTEM																
SUPPLY																
13. Total recharge from surface	434	65	385	127	344	60	263	354	93	217	732	490	40	160	415	234
14. Net subsurface inflow (both aquifers)	-17	11	52	5	-74	-32	58	-90	-61	260	-13	-100	-1	92	0	45
15. Net stream recharge	-100	-50	-200	-20	-70	-10	50	140	80	-140	-60	20	0	100	-80	100
16. Subsidence	0	0	0	0	1	0	2	2	0	1	1	0	0	1	0	1
17. Supply Subtotal	317	26	237	112	201	18	373	406	112	338	660	410	39	353	335	380
DEMAND																
18. Groundwater pumpage	286	27	199	107	179	54	408	503	152	404	503	423	38	382	422	320
19. Loss to moisture deficient soils	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
20. Demand subtotal	286	27	199	107	179	54	408	503	152	404	507	423	38	382	422	320
STORAGE CHANGE																
21. Net increase in storage computed from head change (both aquifers)	29	1	37	1	16	-45	-29	-95	-36	-69	150	-9	-3	-43	-90	51
MASS BALANCE DISCREPANCY																
22. Groundwater supply - groundwater demand - storage increase	2	-2	1	4	6	9	-6	-2	-4	3	3	-4	4	14	3	9
ESTIMATED OVERDRAFT																
23. Groundwater demand - groundwater supply + subsidence	-31	1	-38	-5	-21	36	37	99	40	67	-152	13	-1	30	87	-59

TABLE 3-7
(continued)

	OAU																BASIN TOTALS
	238	239	240	241	242	243	244	245	246	254	255	256	259	258	259	261	
SURFACE SYSTEM																	
SUPPLY																	
1. Surface diversions	190	149	34	348	525	431	963	19	80	293	176	342	0	143	319	151	8879
2. Groundwater pumpage	408	264	54	159	904	843	411	76	47	668	522	430	103	291	54	76	9717
3. Total precipitation	111	115	64	145	366	353	296	55	45	145	127	129	158	88	185	61	5137
4. Supply Subtotal	709	528	152	650	1795	1627	1670	150	152	1106	825	901	261	522	558	288	23733
DEMAND																	
5. Crop evapotranspiration	333	260	68	332	893	770	929	62	67	487	407	477	74	254	236	130	10744
6. Non-crop evapotranspiration	81	62	39	114	219	207	236	50	42	138	116	104	139	78	179	59	3540
7. Municipal and industrial consumptive use	5	5	1	1	14	6	2	1	0	27	0	6	0	4	0	0	185
8. Wildlife consumptive use	0	0	0	0	0	3	0	0	0	0	13	0	0	0	0	0	100
9. Exports and spills	0	0	0	0	0	10	0	0	0	10	6	0	0	0	0	0	518
10. OAU conveyance evaporation	4	3	1	7	10	9	19	0	1	6	4	7	0	3	6	3	178
11. Total recharge to groundwater	286	198	43	196	659	622	404	37	42	438	279	307	48	183	137	96	8466
12. Demand Subtotal	709	528	152	650	1795	1627	1670	150	152	1106	825	901	261	522	558	288	23733
GROUNDWATER SYSTEM																	
SUPPLY																	
13. Total recharge from surface	286	198	43	196	659	622	404	37	42	438	279	307	48	183	137	96	8466
14. Net subsurface inflow (both aquifers)	80	-10	2	32	-30	200	250	7	27	-35	230	-81	-10	24	-106	-30	685
15. Net stream recharge	0	30	0	25	50	-10	-180	0	0	20	0	0	0	0	0	0	-305
16. Subsidence	1	0	0	1	2	8	7	0	1	2	2	2	1	1	0	1	38
17. Supply Subtotal	367	218	45	254	681	820	581	44	70	425	511	228	39	208	31	67	6886
DEMAND																	
18. Groundwater pumpage	408	264	54	159	904	843	411	76	47	668	522	430	103	291	54	76	9717
19. Loss to moisture deficient soils	0	0	0	0	0	0	40	0	0	0	0	0	0	0	70	58	172
20. Demand Subtotal	408	264	54	159	904	843	451	76	47	668	522	430	103	291	124	134	9889
STORAGE CHANGE																	
21. Net increase in storage computed from head change (both aquifers)	-28	-40	-3	88	-194	-20	120	-39	21	-238	-2	-119	-77	-90	-91	-60	-906
MASS BALANCE DISCREPANCY																	
22. Groundwater supply - groundwater demand - storage increase	-13	-6	-6	7	-29	-3	-10	7	2	-5	-9	-83	13	7	-2	-7	-97
ESTIMATED OVERDRAFT																	
23. Groundwater demand - groundwater supply + subsidence	42	46	9	-94	225	31	-103	32	-22	245	13	204	65	84	93	68	1041

for each channel in the surface water distribution network and for the basin as a whole. The DAU-oriented channel recharge contributions reported in Table 3-7 have been estimated from the average recharge values applying to channnels in or on the boundary of the appropriate DAUs. The sum of all of these DAU values is equal to the six-year average of the basin totals computed by SWAM.

It is also important to note that although storage changes and subsurface fluxes are computed by GWM and FLUX for each aquifer, Table 3-7 gives only the net contribution for the two aquifers' subsurface systems. A positive subsurface flux indicates a net inflow while a negative subsurface flux indicates net outflow. In some cases subsurface flows may be moving into one aquifer and out of the other aquifer. The net subsurface inflow for the basin as a whole (indicated in the last column of Table 3-7) originates from four boundary regions. Table 3-8 lists the average base period subsurface inflows crossing each of these regions. The largest single contributor is the eastern boundary at the Sierra foothill edge of the basin. The subsurface inflow crossing this boundary appears to be the primary cause of the steep hydraulic gradient observed along the basin's eastern edge.

As pointed out in Section 3.1, the surface component of the water budget is forced to balance perfectly since the pumpage is always assigned the value needed to make total supply equal total demand. The groundwater component of the water budget is not forced to balance perfectly and, in fact, usually does not. The groundwater budget includes not only supply and demand but also change in storage. If the net increase in storage does not equal the difference between supply and demand, there is a mass imbalance in the budget. Although this imbalance can be disconcerting at first glance, it is actually a useful indicator of possible errors in the model's inputs. Most of the DAU mass imbalances are small fractions of total supply or demand in their respective DAUs. The largest imbalance by far is in DAU 256, which is also the one with the largest confined aquifer head errors. These results together suggest that more effort should be spent on data collection and model calibration for this DAU.

The final point worth noting about the water budget is the definition of the groundwater overdraft. Overdraft is defined as demand less renewable supply.

TABLE 3-8

AVERAGE BASE PERIOD SUBSURFACE
INFLOWS CROSSING BOUNDARY REGIONS

NOTE: All figures are net flows from both aquifers into San Joaquin groundwater basin in thousands of acre feet per year.

BOUNDARY REGION	AVERAGE
Northern region	20.5
Madera region	100.8
East side	504.8
Keck's corner	43.9
TOTAL	670.0

Since subsidence water is a non-renewable supply source, it is subtracted from the total groundwater supply or, equivalently, added to the total groundwater demand is the overdraft calculation.

A review of the basin water budget in the last column of Table 3-7 gives a concise summary of groundwater conditions in the San Joaquin Valley during the six-year period included in the budget. Groundwater pumpage was the largest single source of water (nearly one million acre feet per year greater than surface water) and agricultural evapotranspiration was by far the largest demand (over ten million acre feet per year). The amount of water in storage decreased by about 900,000 acre feet per year and the overdraft was just over one million acre feet per year. The total mass imbalance of 97,000 suggests that the overdraft estimate is accurate to within roughly plus or minus ten percent.

It is interesting to briefly consider the year-to-year change in total basin storage during the six-year period analyzed in Table 4-7. Figure 3-17 shows that the storage change for individual years in the period differed considerabley. Storage dropped sharply during the early years of the period before the full impact of the California Aqueduct was felt. Groundwater storage actually increased during water years 1973 and 1974, partly because of greater than normal rainfall and partly because of increases in surface water deliveries. In water year 1975 storage decreased slightly and in water year 1976, the first of two drought years, storage again fell sharply. It is difficult to say which, if any, of these very different water years is typical. Storage changes for normal rainfall years in the near future probably lies somewhere between the overly pessimistic drop of 1976 and the overly optimistic increases of 1973 and 1974. A normal year overdraft somewhere in the range of 500,000 to one million acre feet per year is a reasonable estimate of current trends. Fortunately, this estimate can be checked as soon as the base period simulation can be extended beyond the 1976 water year into the 1980s.

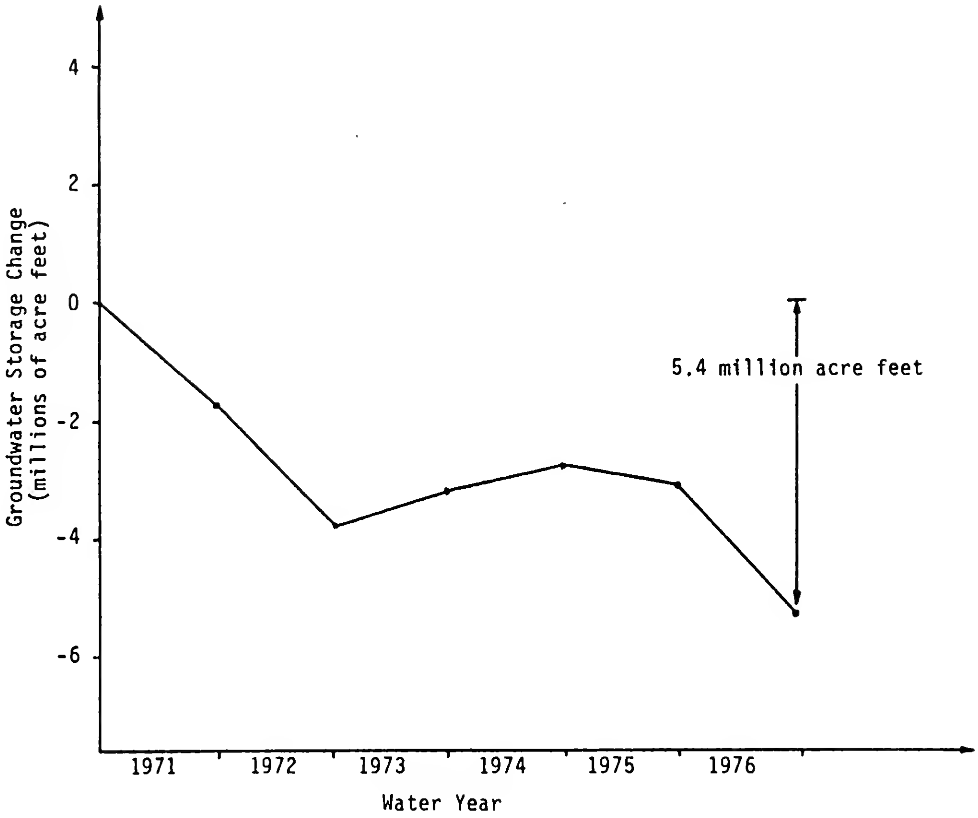


FIGURE 3-17

NET BASE PERIOD STORAGE CHANGE FOR
THE SAN JOAQUIN GROUNDWATER BASIN
(Relative to October 1970)

4. THE SAN JOAQUIN VALLEY PRODUCTION MODEL

4.1 SCOPE, STRUCTURE AND DIMENSION OF THE SAN JOAQUIN VALLEY PRODUCTION MODEL

The San Joaquin Valley Production Model (SJVPM) is a mathematical programming model of the farm level San Joaquin Valley agricultural sector. The agricultural sector is delineated on the basis of various functional criteria: (1) the relationship of crop production activities to the objectives of the study, (2) the relationship that the crop production activities have to different spatial and technological considerations, and (3) the relative economic importance that crop production activities have in determining resource allocation and price.

The spatial aspect is of primary importance. Due to the immobility of land resources, it impacts both the input and output characteristics of the crop production process. Therefore, agricultural production is area (DAU) specific in the SJVPM. The availability and allocation of water resources, the focus of the study, is based on both an area (groundwater) and regional (surface water) basis.

The SJVPM has been structured from the viewpoint of the economic theory of the firm. It is assumed that the sector is composed of many competitive micro units, none of which can individually influence output prices. Each producer supplies according to the rule: equate product price to cost of producing one more unit of that product. Thus, the sectoral supply schedule is an "aggregate" marginal cost schedule. An important point is that the model does not require supply schedules for outputs or demand schedules for factor. Rather, these schedules are derived or projected internally based upon production possibilities, output demand and factor supply.

The separation of supply sources in the SJVPM for the common output demand required that a number of production possibilities exist. The SJVPM currently has over 2000 separate cropping activities to describe alternate production techniques producing the 52 major crop commodities grown in the 33 DAU's comprising the study area. Each cropping technique defines the yield per acre obtained from using a specific irrigation technique (furrow, flood, sprinkler,

drip, furrow/sprinkler) on a prime or non-prime soil using a specified amount of applied water. The relationship between the inputs and yields are those reported in each DAU and not necessarily the biological or profit maximizing combination.

The SJVPM has resource availability delineated by area. The resources delineated are land class (prime and non-prime) and water availability (ground and surface). These availabilities act as constraints on the SJVPM in terms of the amount of output that can be produced. Water is priced at the farm headgate cost for both surface and ground. Agricultural land in production is not priced since it has no opportunity cost outside agriculture in the short run.

The current objective function of the model is the maximization of consumer's surplus and producer's quasi-rents. Consumers' surplus is the sum of consumers marginal valuations above the price which they pay for a commodity. Producers' quasi-rents represent the difference between what producers receive for the crop commodity and the average variable cost of producing the crop. This function assumes that producers operate as profit maximizing price takers (perfect competitors). However, the structure of the SJVPM allows for this assumption to be changed so that other market forms can be simulated. This is an important consideration since the specification of the objective function bears an important relationship to the pricing of the various types of resources that go into the production of agricultural commodities.

The time frame of the SJVPM is yearly. Thus, it is a one-year, static, partial equilibrium model of the San Joaquin Valley agricultural sector. The model can be used to assess changes in farm level production, value and income in any given year by forecasting future output demand schedules, estimating future resource prices, and by forecasting flexibility constraints to constrain allowable acreages of certain crops. The SJVPM does contain provisions for bringing new land into production and thus does allow for partial adjustments in irrigated cropland production from changes in product prices, resource prices, and technology. This, coupled with the fact that the model has the capability of handling water transfers between DAU's and other supply sources endogenously, does provide for some intermdiate time

response within the model's structure. Thus, if "new" water becomes available, this model has the capability of determining its use and whether to increase irrigate acreage or change crop mix.

Figure 4-I provides a matrix tableau representation of the SJVPM.

4.2 SAN JOAQUIN VALLEY PRODUCTION MODEL COMPONENTS

Three major components make up the SJVPM: crop production techniques and costs, crop commodity demands and resource (land and water) availability and cost. Table 4-1 provides a listing of the crop commodities modeled in the SJVPM.

4.2.I CROP PRODUCTION TECHNIQUES AND COSTS

The crop production techniques and costs that make up the more than 2000 separate cropping activities in the SJVPM were all obtained from a set of production crop budgets. Budgets produced by the University of California Cooperative Extension Budget Generator Project at UC Davis were the principal source of information for this effort. (The Kern County Groundwater Model Study provided additional information on cotton, alfalfa, barley, and grapes.) The Budget Generator budgets are developed on a county basis. Both variable and fixed costs are included. They generally assume prime land and good yields. Also, above-average management is assumed do to the fact that the budgets reflect new equipment, machinery, and buildings (resulting in less maintenance expenses) and state-of-the-art agronomic practices. Thus, although the budgets do not reflect any one farm or an average of farms in a county, these assumptions make the budgets for different crops consistent and allow comparison.

Budgets for each principal crop that had been developed by the budget generator for any of the seven counties in the San Joaquin Valley (Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern) were collected. These budgets were first standardized so that agronomic practices for a crop were consistent across counties. For example, insecticide application was listed in all county almond budgets except one, therefore it was added to that

FIGURE 4-1

MATRIX TABLEAU FOR THE

SAN JOAQUIN VALLEY, PRODUCTION MODEL

ACTIVITIES			CROP DEMAND BY CROP COMMODITY				CROP PRODUCTION BY LAND/IRRIGATION TECHNIQUE				WATER SUPPLY AND TRANSFER						LAND DEVELOPMENT AND TRANSFER				
			Grains	Field	Row	F&N*	PL	NPL	Dryland	Pasture	GW	SW	SUPGW	SUPSW	SURGW	SURSW	DPI	DNPI	PID	NPID	IDL
Maximize Z =			Value of Crop Production				-Cost of Production by Acre				± Price of Water						-Cost of Development Per Acre				
ROW NAME	RHS	T	(62.)	(63.)	(64.)	(65.)	(66.)	(67.)	(68.)	(69.)	(70.)	(71.)	(72.)	(73.)	(74.)	(75.)	(76.)	(77.)	(78.)	(79.)	(80.)
LAND																					
(1.) Available Irrigated Prime Land	Ac	=					ac										-1		1		
(2.) Available Irrigated Non-Prime Land	Ac	=						ac		1								-1		1	
(3.) Total Dryland	Ac	=							1								1	1	-1	-1	1
(4.) Irrigated Pasture Only Land	Ac	=								1											
(5.) Irrigable Prime Land	Ac	≤															1				
(6.) Irrigable Non-Prime Land	Ac	≤																1			
WATER																					
(7.) Water Balance	0	=					aw	aw		aw	-1	-1	-1	-1	1	1	aw	aw			
(8.) Available Ground Water	Af	≤									1										
(9.) Available Surface Water	Af	≤										1									
(10.) Supplemental Ground Water	Af	≤											1								
(11.) Supplemental Surface Wtr	Af	≤												1							
(12.) Surplus Ground Water	Af	≤													1						
(13.) Surplus Surface Water	Af	≤														1					
CROPS																					
(14.) DAU Crop Limitations	Ac	≤ ≥					ac	ac	ac	ac											
(15.) Regional Marketing Limitations	Ac	≤					y	y	y	y											
(16.) Demand Balance	0	=	Du	Du	Du	Du	-y	-y	-y	-y											
(17.) Regional Crop Limitations	Ac	≤ ≥					ac	ac	ac	ac											

* Fruits and Nuts

TABLE 4-1

THE SJVPM CROP COMMODITIES

Wheat	Processing Tomatoes
Barley	Almonds
Oats	Fresh Apples
Rice	Processing Apples
Sorghum	Apricots
Sugar Beets	Avacados
Safflower	Figs
Irrigated Pasture	Fresh Grapefruit
Coton	Processing Grapefruit
Corn	Table Grapes
Dry Beans	Raisin Grapes
Alfalfa	Wine Grapes
Snapbeans	Fresh Lemons
Carrots	Processing Lemons
Fall Cauliflower	Nectarines
Other Cauliflower	Olives
Garlic	Fresh Oranges
Lima Beans	Processing Oranges
Lettuce	Peaches
Melons	Pistachios
Onions	Plums
Fresh Peas	Prunes
Processing Peas	Walnuts
Green Peppers	
Winter Potatoes	
Summer Potatoes	
Sweet Potatoes	
Spinach	
Fresh Tomatoes	

county's almond budget unless it was known that insecticide application was not a typical practice in that area.

The budgets were disaggregated from the county level to the DAU level by using DWR's land use surveys, County Agricultural Commissioner reports, and annual statistical publications of the Department of Food and Agriculture. These publications identify the crops grown in different geographic regions of the valley. Since the land use surveys are the most detailed (DAU-level listings), they were used as the primary source of information.

After the initial DAU budgets had been developed using the best available information as described above, they were grouped by county and sent to the Cooperative Extension in each of the seven counties. Appointments were made to interview the county farm advisors in each county after they had approximately two weeks to review the budgets. A&A personnel, accompanied by representatives from DWR, made several trips to the Valley to interview the county farm advisers in each county and discuss their comments on the budgets. Most of the comments from the advisors centered around a few major objections: the difficulty of representing all the possible input combinations that can produce a given crop in one budget; the above-average management practices implied; and data inaccuracies, particularly yields. Although the first two objections are valid, it was explained that the budgets were never meant to represent all farms and all possible agronomic practices, but rather a typical, realistic set of practices and yields that could be achieved using management practices that are efficient and feasible. Data corrections were verified and incorporated in the budgets when possible. Information obtained from the advisers on crop locations and irrigation technologies was also used to revise the budgets.

The budgets were further refined during the verification of the agriculture production model. Since the amount of agricultural production in the San Joaquin Valley in 1978 was known, the budgets were revised so that the model output corresponded more closely to published data. Most of the revisions were in yields.

The result of this effort was over 2000 crop production techniques and costs that make up the crop production component of the SJVPM. These crop production techniques and costs are specific to location, land type, and irrigation technology. An example of a crop budget developed for the SJVPM is shown in Table 4-2. This budget contains only variable costs since the production model is based on maximization of consumer benefits and producers' quasi-rent (returns to fixed asssets) rather than net profit. A more detailed discussion of the crop budget development process is contained in Noel (1980 e).

4.2.2. CROP COMMODITY DEMANDS

The crop commodity demands represent the second major component of the SJVPM. These demands are in the price-dependent form. Equation 4.1 illustrates this form.

$$P = A + B_1 Q_c + B_2 Q_o + B_3 Y \qquad (4-1)$$

where:

P is the unit price

Q_c is California production

Q_o is other U.S. production or other non-SJV substitute crop production

Y is U.S. personal disposable income

A, B_1, B_2, and B_3 are estimated coefficients relating the above-defined variables to the California price.

The equation 4-1 can be further reduced to the form:

$$P = A' + B_1 \; Q_o \qquad (4-2)$$

The A' terms contains the information from all the other variables. This specification is necessitated by the structure of the SJVPM. The SJVPM structure allows only price and quantity variables to appear in the objective function in order that there be compatibility between it and the other

TABLE 4-2 SAMPLE BUDGET

RICE (NONROTATION SYSTEM) VARIABLE PRODUCTION COSTS, DAU 206
YIELD= 2.85 NET TONS/ACRE
TYPICAL PRACTICES REPRESENTED
IRRIGATION: BORDER CHECK
HARVEST MO.: OCTOBER
BUDGET YEAR: 1978 RUN DATE: 06/30/81
PRIME LAND

	UNIT	PRICE OR COST/UNIT (DOLLARS)	QUANTITY	VALUE OR COST/ACRE (DOLLARS)
PREHARVEST ACTIVITIES				
SEED	LBS.	.157	150.000	23.55
CUSTOM AIR SEED	LBS.	.029	195.000	5.65
CUSTOM HAULING	LBS.	.003	195.000	.58
IRRIGATION LABOR	HRS.	4.250	7.800	33.15
MACHINERY LABOR	HRS.	5.100	2.700	13.77
MOVE EQUIPMENT	ACRE	.980	1.000	.98
AQUA FERTILIZER	LBS.	.200	125.000	25.00
STARTER FERTILIZER	LBS.	.160	100.000	16.00
TOP DRESS FERTILIZER	LBS.	.300	25.000	7.50
GRASS KILLER	ACRE	17.600	1.000	17.60
BROADLEAF HERBICIDE	LBS.	3.380	1.000	3.38
HERBICIDE APPLICATION	ACRE	2.540	1.000	2.54
HERBICIDE APPLICATION	ACRE	3.200	1.000	3.20
INSECTICIDE APPLICATION	APLC	2.470	1.000	2.47
METHYLPARATHION	ACRE	3.600	.600	2.16
EQUIPMENT RENTAL	ACRE	2.500	1.000	2.50
EQUIP.-LEVEE	ACRE	3.000	1.000	3.00
LEVEES-BOXES	ACRE	2.820	1.000	2.82
BUILDINGS(FUEL-LUBE-REPAIRS)	ACRE	.020	1.000	.02
EQUIPMENT(FUEL-LUBE-REPAIRS)	ACRE	9.830	1.000	9.83
TRACTOR(FUEL-LUBE-REPAIRS)	ACRE	28.790	1.000	28.79
IRRIGATION SYSTEM(FUEL-LUBE-REPS.	ACRE	3.440	1.000	3.44
INTEREST ON OPERATING CAPITAL	$$$$	.086	207.940	17.88
TOTAL PREHARVEST COSTS				$ 225.82
HARVEST ACTIVITIES				
CUSTOM DRYING	TONS	10.500	3.180	33.39
CUSTOM HAULING	TONS	4.180	3.180	13.29
MACHINERY LABOR	HRS.	5.100	2.200	11.22
POST HARVEST	ACRE	3.000	1.000	3.00
EQUIPMENT(FUEL-LUBE-REPAIRS)	ACRE	32.850	1.000	32.85
INTEREST ON OPERATING CAPITAL	$$$$	.086	93.752	8.06
TOTAL HARVEST COSTS				$ 101.82
TOTAL VARIABLE COSTS				$ 327.64

NOTES:
500-ACRE CROP
700-ACRE FARM

variables in the SJVPM. The estimation was done using both ordinary least squares, and a generalized least squares estimator. A report on the crop commodity estimation procedure, hypothesis testing, and data set is available in Noel (1982c.)

Data for the estimates were obtained from California Food and Agriculture publications, USDA Agricultural Statistics, and "California Agricultural Crop Statistics: A Data Base Management Approach" published by the University of California, Giannini Foundation. Data on crop prices, quantities, substitute crop quantities, imports, price indices, and income were collected. For most crop commodities, a time series of data from 1946-1978 was available. These 33 years of data provided a time series sufficiently long to capture a price - quantity relationship.

Altogether 50 California crop commodity demands were estimated and two (cotton and sugar beets) that were determined from other studies (King, et.al. (1978)).

The 52 crop commodity demands can also be used to forecast future production and crop prices for future years. By forecasting future disposable income and production of substitute crop commodities outside the SJV, it is possible to forecast future demand levels. For example, the prime forecasting equation estimated for fresh oranges is:

$$P = 419.18 - .24599\ Q_c - .017449Q_o + .029392Y$$

Suppose the 1980 values for income (Y) and other U.S. orange (Q_o) production are 1458.4 ($ billions) and 682 (1000 tons) respectively. Substituting these values into the equation and adding the results to the intercept gives the following:

$$P = 419.18 - .24599\ Q_c - .017449\ (682) + .029392\ (1458.4)$$
$$P = 450.15 - .24599Q_c$$

The California crop commodity demands were adjusted down to the San Joaquin Valley (SJV) level by altering their intercept terms, under the assumption the California and SJV crop commodity demand functions are parallel. This assumption implies that the underlying demand determinants are identical for both the SJV producers and the California producers but that the price flexibilities differ. This seems a reasonable assumption given the fact that for a large majority of the crops that SJV producers accounted for the largest share of production in the State.

4.2.3 RESOURCE AVAILABILITY AND COST

Resource availability and cost make up the third component of the SJVPM. Two resources are differentiated in the SJVPM. These resources are land and water.

Irrigable land in each DAU has been subdivided into prime and nonprime irrigated land, and prime and nonprime nonirrigated land.

Preliminary figures for total irrigable land were taken from the detailed Land Classification Summaries provided by DWR. If DWR's more current Land Use Surveys indicated an increase in urban land in a DAU, this increase was subtracted from the preliminary figure to get a more accurate amount of total irrigable land. Figures for irrigated land were also obtained from DWR Land Use Surveys. Nonirrigated land figures were derived by subtracting irrigated land from irrigable land.

The DWR Land Classification Summaries categorize irrigable land into three general categories according to the slope of the land. These categories are further subdivided to represent different textures, salinity problems, etc. It was determined from these land classification categories in consultation with DWR land and water use analysts the amount of prime and nonprime land available in each DAU in the study area.

A fairly general methodology was then established to determine how the land classes should be divided into irrigated and non-irrigated status. A detailed description of this is contained in Noel (1982c). In general, it was

determined that most of the prime land in a DAU would be irrigated, and that the remainder would be nonprime. Thus, if total irrigated land is known and prime land is known, the remainer would be irrigated nonprime land. Then of the total irrigable land in a DAU the amount not irrigated would in most cases be nonprime land. There are exceptions to this but they are not common. This land set was then reviewed by DWR land and water use analysts and from their comments a final land data base was established. This is presented in Table 4-3.

As previously discussed, agricultural land in production is not priced; however, the SJVPM does allow for non-irrigated land to come into production. A development cost per acre was established based on the information obtained from DWR about the type of reclamation that would be necessary in the different DAUs that had developable irrigable land. The development cost was amortized over a period of five to seven years and resulted in per-acre development costs in the range of $100.00/AC to $350.00/AC. Additionally, the SJVPM requires that under certain types of reclamation additional water must be used to leach salts from the soil.

The water resources in the SJVPM are divided into surface and groundwater by DAU. The availability of both of these water resources for any given period of time comes from two other models making up the HEM system. The surface water availability for SJVPM use comes from the Surface Water Allocation Model (SWAM), and the groundwater availability and cost come from the Linear Quadratic Control Model (LQCM). This interaction between these three models is discussed in Chapter 2. Surface water costs, however, were estimated independently of the HEM system. That is the SJVPM is given a surface water costs that were forecasted independently of surface water availabilities. The rational being that most, if not all, of the surface water used in the SJV is priced by contracts or other legal institutions which bear no relationship to the true price-quantity relationship. That is, price is independent of quantity for surface water allocated to a particular DAU.

Surface water costs were forecasted for the years 1980, 1985, 1990, 1995, and 2000 for use by the SJVPM in doing the scenario runs. The following is a

TABLE 4-3
IRRIGABLE LAND
(THOUSANDS OF ACRES)
BY DAU

DAU	TOTAL IRRIGABLE LAND		IRRIGATED LAND		NON-IRRIGATED LAND	
	PRIME	NON-PRIME	PRIME	NON-PRIME	PRIME	NON-PRIME
206	147.0		131.2		15.8	
	92.6	54.4	92.6	38.6	.0	15.8
207	80.2		9.0		71.2	
	3.8	76.4	3.8	5.2	.0	71.2
208	185.0		171.0		14.0	
	156.6	28.4	156.6	14.4	.0	14.0
209	124.4		62.2		62.2	
	19.9	104.5	19.9	42.3	.0	62.2
210	139.3		126.7		12.6	
	107.9	31.4	107.9	18.8	.0	12.6
211	123.2		14.5		108.7	
	5.5	117.7	5.5	9.0	.0	108.7
212	210.7		124.8		85.9	
	68.9	141.8	68.9	55.9	.0	85.9
213	167.0		158.1		8.9	
	123.3	43.7	123.3	34.8	.0	8.9
214	175.8		65.0		110.8	
	27.9	147.9	27.9	37.1	.0	110.8
215	157.4		103.7		53.7	
	54.8	102.6	54.8	48.9	.0	53.7
216	583.7		377.4		206.3	
	297.2	286.5	297.2	80.2	.0	206.3
233	201.1		183.1		18.0	
	128.8	72.3	128.8	54.3	.0	18.0
234	43.0		10.5		32.5	
	9.0	34.0	9.0	1.5	.0	32.5
235	175.8		148.8		27.0	
	62.7	113.1	62.7	86.1	.0	27.0
236	163.4		154.9		8.5	
	156.3	7.1	154.9	.0	1.4	7.1
237	172.5		161.8		10.7	
	62.9	109.6	62.9	98.9	.0	10.7
238	157.7		131.4		26.3	
	92.9	64.8	92.9	38.5	.0	26.3

TABLE 4-3 CONTINUED
IRRIGABLE LAND
(THOUSANDS OF ACRES)
BY DAU

DAU	TOTAL IRRIGABLE LAND			IRRIGATED LAND			NON-IRRIGATED LAND		
		PRIME	NON-PRIME		PRIME	NON-PRIME		PRIME	NON-PRIME
239	123.6	74.2	49.4	112.2	74.2	38.0	11.4	.0	11.4
240	46.5	9.9	36.6	32.1	9.9	22.2	14.4	.0	14.4
241	249.3	37.1	212.2	224.2	37.1	187.1	25.1	.0	25.1
242	402.2	231.1	171.1	349.4	231.1	118.3	52.8	.0	52.8
243	409.6	176.9	232.7	330.8	176.9	153.9	78.8	.0	78.8
244	577.0	433.4	143.6	516.8	433.4	83.4	60.2	.0	60.2
245	190.8	143.3	47.5	45.1	45.1	.0	145.7	98.2	47.5
246	93.7	32.8	60.9	41.9	32.8	9.1	51.8	.0	51.8
247	1.0	.4	.6	.0	.0	.0	1.0	.4	.6
254	296.9	162.7	134.2	226.3	162.7	63.6	70.6	.0	70.6
255	267.4	56.9	210.5	176.4	56.9	119.5	91.0	.0	91.0
256	219.5	179.4	40.1	205.5	179.4	26.1	14.0	.0	14.0
257	80.2	12.3	67.9	40.7	12.3	28.4	39.5	.0	39.5
258	149.2	134.0	15.2	121.6	121.6	.0	27.6	12.4	15.2
259	337.2	221.1	116.1	158.0	158.0	.0	179.2	63.1	116.1
260	39.0	26.4	12.6	1.8	1.8	.0	37.2	24.6	12.6
261	127.1	94.4	32.7	85.4	85.4	.0	41.7	9.0	32.7

description of the methodology used to derive water costs by DAU for the years 1980, 1985, 1990, 1995, and 2000.

Table 6B in DWR's Statewide Planning Program, Bulletin 160 82 Studies, Study Area 1: San Joaquin Basin (August 1980) and Study Area 2: Tulare Basin (August 1981) lists by DAU the source of water, type of water right, quantity, and price for each surface water diverter. Using this quantity and price information (supplemented by notes from DWR land and water analysts and economists and DWR's Purveyors Survey), weighted average prices were calculated for each DAU in the San Joaquin Valley for the base year 1980.

Cost for each diverter in a DAU were then escalated according to the source of water. Appropriative and riparian water costs were escalated one percent yearly to the year 2000. CVP water costs were not escalated for 1981 - 1982; escalated two percent yearly for 1983 - 1985; and escalated at one percent yearly for 1985 - 2000. Most existing CVP contracts will be in effect throughout the period 1980 - 2000, so escalations for CVP water reflect primarily increases in O&M costs.

SWP contracts will be renegotiated in the next few years so the escalations for SWP costs also had to reflect increased energy prices and increases in capital costs incurred from new facilities constructions. DWR's Bulletin 132-81, The California State Water Project Current Activities and Future Management Plans breaks water cost projections into capital, OM&R, and energy components. These projections show energy costs increasing approximately 500 percent between 1981 - 1985, 20 to 30 percent between 1985 - 1990, and approximately five percent between 1990 - 1995 and 1995 - 2000 (Exhibit 2, page 13; Table 1, pp. 16-17; Exhibit 29, page 175). These energy price increases were thought to be too dramatic, so it was decided to use DWR's projected increases for capital and OM&R cost but to escalate the energy component at four percent yearly from 1980 - 2000. Using these escalated rates and initial values given in Exhibit 2 for the Kern County Water Agency and other San Joaquin Valley purveyors, percent increases calculated for SWP water costs were as follows:

	1980-1985	1985-1990	1990-1995	1995-2000
KERN COUNTY WATER AGENCY	41.2%	53.7%	2.4%	2.4%
OTHER SAN JOAQUIN PURVEYORS	60.7%	60.0%	1.4%	2.7%

After costs for each diverter in a DAU had been projected through the year 2000 using the relevant escalation rates, weightful average costs for each DAU were calculted for the years 1985, 1990, 1995, and 2000. Results are given in Table 4-4.

4.3 DERIVED DEMANDS FOR WATER

The SJVPM can be used for many purposes but one of its best uses is to determine water demand function at the DAU level. This was done using the SJVPM for the years 1980, 1985, 1990, 1995, and 2000. The water demand functions are derived from the crop commodity demands since as the value of growing a certain set of crops changes the value of the water used in agricultural production changes. As previously stated the crop demand functions were forecast for 1980, 1985, 1990, and 2000. As these crop demands change, so will the water demand functions; thus, water demand functions must be re-estimated everytime a new set of crop demand functions is placed into the SJVPM.

The data set necessary for the water demand function estimation can be obtained by repeated runs of the SJVPM where the availability of water in each DAU is reduced in each run. There exists a value associated with the water availabilities in each of these runs called the dual value. These dual values can be interpreted as the marginal values of the availabilities given specific crop demands. Thus, by specifying a set of crop demands and changing water availabilities it is posible to get a data base from which the water demands associated with a particular set of crop demands can be estimated. Since crop

TABLE 4-4

WEIGHTED AVERAGE SURFACE WATER COSTS
SAN JOAQUIN VALLEY
($/ac.ft.)

DAU	1980	1985	1990	1995	2000
206	3.52	3.70	3.89	4.09	4.30
207	.90	.95	1.00	1.05	1.10
208	1.05	1.10	1.16	1.22	1.28
209	4.36	4.58	4.81	5.06	5.32
210	9.13	9.60	10.09	10.60	11.15
211	.00	.00	.00	.00	.00
212	7.64	8.05	8.46	8.89	9.35
213	11.04	11.70	12.30	12.92	13.58
214	2.47	2.59	2.72	2.86	3.01
215	4.18	4.43	4.66	4.89	5.14
216	9.79	10.36	10.89	11.44	12.03
233	3.36	3.53	3.71	3.90	4.10
234	4.67	4.94	5.19	5.46	5.74
235	5.70	6.05	6.36	6.68	7.02
236	3.63	3.82	4.01	4.22	4.43
237	10.85	11.49	12.08	12.69	13.34
238	7.00	7.65	9.24	9.56	10.07
239	3.37	3.54	3.72	3.91	4.11
240	13.89	14.75	15.50	16.29	17.12
241	18.45	19.41	20.40	21.44	22.53
242	10.36	10.97	11.52	12.12	12.73
243	11.36	12.04	12.65	13.30	13.98
244	16.15	17.14	18.01	18.93	19.90
245	35.32	43.44	74.72	75.47	79.24
246	29.75	36.59	62.94	63.57	66.75
254	11.96	12.76	16.08	16.74	17.42
255	19.84	21.52	32.72	33.77	34.86
256	17.59	18.91	24.68	25.64	26.64
257	38.65	59.18	69.65	80.14	82.66
258	33.27	35.62	44.10	45.94	47.86
259	44.82	48.85	78.15	80.49	82.91
260	39.40	42.95	68.71	70.78	72.90
261	39.40	42.95	68.71	70.78	72.90

TABLE 4-5

DERIVED EQUATIONS FOR WATER AND GROUNDWATER
AND ELASTICITIES
(P=a+bQ)
1980

DAU	Slope	Water Intrcpt	Grdwtr Intrcpt	R-Sq	Forecast Price	Elasticity No. 1	Elasticity No. 2
206	-.000419920	210.39	.00	.39	3.52	-0.01702	0.00000
207	-.001497800	48.91	28.54	.54	.90	-0.01874	-1.40087
208	-.000542930	278.56	.00	.62	1.05	-0.00378	0.00000
209	-.000879760	183.10	83.60	.65	4.36	-0.02439	-0.84020
210	-.000372730	200.45	.00	.77	9.13	-0.04772	0.00000
211	-.003050800	159.96	143.18	.55	.00	0.00000	-8.53278
212	-.000192230	76.04	47.60	.91	7.64	-0.11170	-1.67370
213	-.000331200	204.33	99.64	.61	11.04	-0.05712	-0.95176
214	-.002469200	501.18	447.10	.95	2.47	-0.00495	-8.26738
215	-.000253160	134.36	112.66	.96	4.18	-0.03211	-5.19171
216	-.000227790	225.05	.00	.87	9.79	-0.04548	0.00000
233	-.000671550	336.94	.00	.69	3.36	-0.01007	0.00000
234	-.014468000	375.66	116.68	.74	4.67	-0.01259	-0.45054
235	-.000276500	153.04	142.95	.96	5.70	-0.03869	-14.16749
236	-.002172000	1095.30	234.75	.90	3.63	-0.00333	-0.27279
237	-.000257990	156.62	92.61	.97	10.85	-0.07443	-1.44681
238	-.000211000	130.21	86.31	.86	7.00	-0.05681	-1.96606
239	-.001413300	420.35	144.33	.75	3.37	-0.00808	-0.52290
240	-.004620900	553.54	351.14	.92	13.89	-0.02574	-1.73488
241	-.000089188	90.96	75.40	.72	18.45	-0.25444	-4.84514
242	-.000161300	230.72	119.07	.60	10.36	-0.04701	-1.06646
243	-.000116980	129.50	65.27	.87	11.36	-0.09616	-1.01619
244	-.000077605	160.17	126.09	.72	16.15	-0.11214	-3.69982
245	-.001126200	159.84	147.34	.91	35.32	-0.28365	-11.78720
246	-.001535800	157.69	94.25	.93	29.75	-0.23253	-1.48566
254	-.000241710	196.35	104.11	.95	11.96	-0.06486	-1.12869
255	-.000200180	162.50	135.30	.85	19.84	-0.13907	-4.97426
256	-.000508070	337.38	111.24	.76	17.59	-0.05500	-0.49191
257	-.004613400	401.39	124.59	.91	38.65	-0.10655	-0.45011
258	-.001400200	364.49	210.61	.81	33.27	-0.10045	-1.36866
259	-.000425300	238.28	153.73	.77	44.82	-0.23168	-1.81821
260	-.011551000	344.44	148.07	.91	39.40	-0.12916	-0.75404
261	-.000626330	207.07	107.73	.66	39.40	-0.23499	-1.08446

Elasticity No. 1 is elasticity calculated at forecast surface water price.
Elasticity No. 2 is elasticity at groundwater intercept.

commodity demands were forecasted for 1980, 1985, 1990, 1995, and 2000, water demand functions were estimated for each of those periods.

The water demand functions were estimated in a price dependent form as shown in equation (4-3).

$$P = a - b_Q \qquad (4\text{-}3)$$

Where P is the value of water per acre-foot for a specific amount of water in a specific DAU and Q is the specific amount of water in an acre-foot. Once this equation is estimated it can be used to derive the groundwater demand. The reason the groundwater demand cannot be estimated directly from the SJVPM data set is that the SJVPM treats groundwater and surface water as substitutes. That is, the SJVPM assumes that both of these water sources have comparable water quality and the water user will differentiate between them solely on a cost per acre-foot basis.

The groundwater demand function can be determined by subtracting the surface water supply for a given year. An example should surfice to exxplain how this is done. Suppose that the water demand for DAU 206 was:

$$P = 210.39 - 9.99941992\ Q$$

Where P is dollars per acre-foot and Q is acre-feet. Now let surface water quantity (supply) be 400,000 acre-feet then the above can be written as a groundwater demand function as:

$$P_{GW} = 210.39 - 0.00041992\ (400000) - 0.00041992\ Q_{GW}$$
$$P_{GW} = 42.43 - 0.00041992\ Q_{GW}$$

This determination process pre-supposes that surface water is the cheaper resource and will be used first when it is available.

Table 4-5 shows the set of water demand functions and groundwater demand functions estimated for 1980. This table also shows the price-elasticity calculated from the water demand functions. These elasticities can be

interpreted as the percentage change in quantity of water demanded that would occur with a one-percent change in price. Note that at the forecasted 1980 price, the elasticities are quite low while at the groundwater intercept (the true marginal value associated with the available surface water) that the elasticities are quite high. This partially explains why agricultural water users maintain that they are willing to purchase more surface water even if the price is slightly higher than they are paying. At forecast prices the elasticity is so small in most cases that a slight or even moderate change in price will not have much impact on the quantity of surface water demanded. It is not until the price gets fairly high that users would become responsive to price changes.

The groundwater demands are obtained from the water demands by subtracting out the surface water supply. This presupposes that surface water is the cheaper resource and will be used first when it is available. The exact detailed procedure of how this was accomplished is contained in Noel (1982c).

4.4 SAN JOAQUIN VALLEY PRODUCTION MODEL VALIDATION

Given the economic logic underlying the SJVPM and its empirical specification, a question that is most often asked is: Now that the model is complete, do we have any confidence in the answers it gives? Validation or verification of these models has been examined by several researchers. The basic validation tests which have been used involve: 1) how well the model solution, when specified with base period date, corresponds to the real situation in that base period; 2) whether the model can feasibly produce the base period demand quantity; and 3) how well the model replicates the base period price when producing a fixed level of output equal to the base period quantity.

Two issues cloud these validation "tests" as they relate to the SJVPM. The first is that the validation tests which have been used generally relate to aggregate results. Regional production activities have not been systematically validated in the literature found by the author. Secondly, the regional data necessary for modeling and validation are not always available. For example, data available on yields and production was limited on a DAU level.

Both of these issues were of concern for the validation of the SJVPM. The SJVPM by nature of its structure and empirical specification is disaggregated to the DAU region with 33 DAU's making up the San Joaquin Valley agricultural area. Disaggregation can lead to a problem when developing and using the SJVPM. This problem is the possible divergence that will occur between actual market results and the solution of a model. Other potential sources for differences in actual and predicted market outcomes include risk and uncertainty, agronomic limitations, adjustment costs, credit market conditions, and operation of government programs.

Initial results of the SJVPM computer runs did indicate large differences between model results and reality. Two sources of error were readily apparent. The first source of error was the degree of disaggregation in the SJVPM is not great enough to capture the yield and hence cost variability, that exists between different DAU's growing the same crop and the same DAU growing different crops. Also, the true cost for growing different crops or the same crop in different DAU's are most likely not well represented by a single cost figure. This is due to the fact that the input combinations necessary for growing the same crop or different crops vary within and between DAU's. The necessary input combinations for crop production are related to changing soil types. For example, sandy soils require a different mix of inputs than do clay soils. Also, different soils have different inherent productivity in the growing of different crops. Tomatoes, for instance, grow better on clay loam soils than they do on sandy soils. Climatic differences north to south also affect the input combinations as do the availability of resources especially water. Thus, even though input costs, except for water costs, do not vary from north to south in the San Joaquin Valley, the true cost of production, due to changes in input combinations, does.

The two primary reasons that the SJVPM does not account for this variation in input combinations and hence production costs are: 1) data availability and 2) model dimensionality. The data necessary to adequately describe the input combination variability may exist but it is not readily available and the expense of compiling it would probably be quite large. The second reason,

model dimensionality, is related to the first, data availability. Even if the data were collected the size of the production possibility set would have to be enlarged six to ten times to achieve the necessary size for the SJVPM to account for the cost variability. Since there are already over 2000 production activities this means that there would have to be 12000 to 20000 production activities. Although, MINOS (the solution algorithm) may be able to handle this size problem the cost of running it would be quite large.

This inadequate accounting for input combination changes led to per acre crop production costs that did not vary much north to south. Thus, crop allocation was keyed to yield differences and water costs since the cost per unit yield and the cost of water did vary from north to south. These differences resulted in cropping patterns where high valued crops were grown and where specific DAUs grew all or the majority of a specific crop.

Another initial result was that only 20 of the possible 52 crop commodities were in the model solution. Although this can be related to the lack of cost variability, it also has to do with the fact that the slopes of the demand functions for these crop commodities were not large enough to impact production of them until very large acreages were grown.

This follows from the fact that the steeper the demand curve for a crop commodity the faster prices will drop with increases in supply. The SJVPM is maximizing the value of producion and if the curves were steep it would limit production at some level, ceterus paribus. However, many of the crop demands estimated had relatively flat slopes which meaans that large changes in supply are necessary to get small price changes. It is these commodities that the SJVPM tends to produce in its effort to maximize the value of production.

These results lead to a dilemma since a model which does not validate leaves the modeler in a difficult position. Models like the SJVPM are conditional and normative by nature and are therefore frequently valid by assumption. Tests involving validation have been attempted by other researchers but when a model is "invalid" the model is usually examined carefully in terms of adequacy of coefficients and/or structure. This is what was done with the SJVPM.

In order to make the model more closely approximate reality, three things were done. First, the production possibilities and cost of production data set were re-examined. The original data set for the SJVPM took over a year of time and effort to collect, review, and refine. It depends on several sources of data: DWR land use surveys, Agricultural Commission reports, California Livestock and Reporting Service Publication, Soil Conservation Service reports and surveys, USDA River Basin Study reports, County Farm Advisor reports, and University of California Extension Service Bulletins and reports.

The data base, as it now exists, can be characterized as variable with respect to published data. The variable nature of this data set is the second problem mentioned concerning the validation of the SJVPM. It was hard to know exactly what actual (1978, the model's base year) crop production and acreage figures to compare the model's results against. The variable nature of the data set used in the SJVPM and figures reported by various local, state and federal agencies made data base validation very difficult. Each of these agencies has its own reporting procedure and an examination of the crop acreages, water use, crop prices, and land use showed differences between them, some quite large. For example, the Soil Conservation Service reports on average cotton yield in the southern San Joaquin Valley averages 1.5 bales to the acre. Farm Advisor reports, and California Livestock and Reporting Service figures indicate an average of 2 to 2.2 bales to the acre. These types of discrepancy exists among all of the data sets. Possible reasons for these differences are the data collection and processing techniques used by different agencies, and also that some degree of subjectivity exists in the reports published by the various agencies.

The data base was thus re-examined with the above variability of data in mind. It was assumed that the 1978 California Livestock and Crop Reporting Service (CLCR) reported farm level price information was accurate and the remaining data (yields, acreages, total production and production costs) were evaluated for consistency with respect to the reported price. For example, if in a specific area the yield was reported as 50 tons per acre and 100,000 accreages were grown, was the total reported production close to 5,000,000 tons, land if

all areas' production was aggregated, did it come close to the total production eported as reported by CLCR or the Agricultural Commissioner Reports. This same type of process was carried out for the entire data set. Therefore, the data set now has internal consistency and its variability is with respect to other published data.

The second validation procedure undertaken was to review the crop demand functions. This was done with the validation question of how closely do the demand functions predict prices compared to actual prices when producing a level of output close to the base period quantity. The demand function review process included re-evaluating the data base used, and in instances where it was warranted, some of the demand functions were re-estimated.

The results of the first two validation procedures, a critical review of the data set, and evaluation of the demand function estimation and data set, resulted in base period model that was more realistic in that a total of 40 crops entered the solution basis. However, the spatial allocation was still not good and spatial specialization was still occurring. This was primarily due to the lack of input combination variability discussed earlier.

The third validation procedure applied to the model was to place acreage constraints on crop acreage on a DAU basis. This was done so that some of the aggregation bias, lack of cost variation, risk averseness, and other market factors that are not accounted for by the model endogeneously, would be accounted for in an exogeneous manner. An early attempt was made to endogenize the crop acreage constraints into the model's objective function. This is done by endogenizing the dual variable on binding acreage constraints into the objective function, the assumption being that these variables are in fact a measure of the previously discussed market factors which are not included in the regional (DAU) crop cost figures. However, due to data limitation and computational difficulties, this procedure was not successful. Thus, the spatial allocation properties of the model are due to the fact that approximately 90 percent of the DAU crop acreage constraints were binding in the base period run.

This restricts the SJVPM's forecasting ability. It does not, however,

invalidate the model's intended use. The SJVPM intended use was to be one of four models making up the HEM system. It's role in the system was two-fold. One was to provide a data base that could be used for the estimation of water demand functions and consequently groundwater demand functions. This function of the model can be done even if all the crop constraints are binding since the model will still impute the dual values of the remaining constraining resources correctly. The second role of the SJVPM was to provide information about cropping patterns, changes in land use, water use, and farm income resulting from different water management scenarios. If it is found that the acreage constraints are binding then this must be taken into account by the researcher. However, nothing prevents the researchers from changing these constraints to reflect what might be better information about upper limits to crop production in a specific DAU or set of DAUs.

The constraint set currently being used for the base period model and for the 1980, 1985, 1990, 1995 and 2000 models were developed from USDA projections, DWR projections and research done by various individuals (dissertaions, Giannini monographs and bulletins, and extension material from the University of California). The model then has the capabilities of choosing an optimal crop mix and changes in land use, water use, and farm income given different crop demands, production costs, and resource (land and water) availabilites and costs within the confines of the DAU specified crop constraints. The crop acreage constraint set for each of the years of analysis is available for review. This constraint set is part of Appendix E of this report.

The results of the 1978 base SJVPM are presented in Tables 4-6, 4-7 and 4-8. Table 4-6 shows the total irrigated prime land, total irrigated nonprime land, total groundwater, total surface water, and the total crop acreages and equilibrium prices predicted by the model. Table 4-7 shows the DAU distribution of crop acreages. Table 4-8 provides a comparison of the predicted 1978 crop acreages with published figures in the Agricultural Commission reports and California Crop and Livestock Reporting Service reports for the same time period.

The results in Table 4-6 indicate that 4,533,539 acres were irrigated cropland

TABLE 4-6
RESULTS OF SJV PROGRAMMING MODEL

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,295,039.0
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,238,500.0
TOTAL GROUND WATER USED (AC-FT)	7,292,900.0
TOTAL SURFACE WATER USED (AC-FT)	8,378,899.0

CROPS PRODUCED

CROP	ACRES	PRICE	UNIT
WHEAT	143,741.0	5.42	CWT
BARLEY	533,490.1	4.85	CWT
OATS	10,500.0	5.02	CWT
RICE	22,323.0	7.05	CWT
SORGHUM	59,842.0	4.44	CWT
SUGAR BEETS	54,805.0	25.80	TON
SAFFLOWER	55,447.0	230.00	TON
IRRIGATED PASTURE	243,779.8	134.62	ACRE
COTTON	1,406,696.0	306.72	BALE
CORN	194,058.0	5.16	CWT
DRY BEANS	73,761.0	24.50	CWT
ALFALFA	414,502.0	62.00	TON
SNAPBEANS	2,600.0	570.00	TON
CARROTS	11,295.0	8.50	CWT
FALL CAULIFLOWER	1,350.0	20.70	CWT
OTHER CAULIFLOWER	2,120.0	23.27	CWT
GARLIC	4,730.0	316.00	TON
LIMA BEANS	12,630.0	340.00	TON
LETTUCE	16,730.0	181.40	TON
CANTALOUPS	35,878.0	183.45	TON
ONIONS	15,350.0	135.00	TON
FRESH PEAS	1,650.0	542.00	TON
PROCESSING PEAS	4,050.0	154.00	TON
BELL PEPPERS	2,300.0	14.39	CWT
WINTER POTATOES	1,360.0	8.00	CWT
SPRING POTATOES	24,905.0	7.45	CWT
SWEET POTATOES	8,100.0	290.05	TON
SPINACH	2,700.0	63.30	TON
FRESH TOMATOES	10,371.0	373.74	TON
PROCESSING TOMATOES	59,483.0	54.11	TON
ALMONDS	228,655.0	1,400.11	TON
FRESH APPLES	1,170.0	260.03	TON
PROCESSING APPLES	1,570.0	180.00	TON
APRICOTS	11,741.0	233.10	TON
AVOCADOS	950.0	690.98	TON
FIGS	12,368.0	318.00	TON
GRAPEFRUIT	900.0	195.40	TON
TABLE GRAPES	62,623.0	288.00	TON
RAISIN GRAPES	247,236.0	228.00	TON
WINE GRAPES	187,120.0	210.00	TON
FRESH LEMONS	2,286.0	222.89	TON
PROCESSING LEMONS	5,053.0	22.63	TON
NECTARINES	14,037.0	303.60	TON
OLIVES	23,136.4	306.12	TON
FRESH ORANGES	87,714.0	206.75	TON
PROCESSING ORANGES	38,361.0	38.70	TON
PEACHES	45,792.0	160.00	TON
PISTACHIOS	6,283.0	1,400.00	TON
PLUMS	24,745.0	377.00	TON
PRUNES	5,486.0	696.00	TON
WALNUTS	69,275.0	1,264.00	TON

and 122,219 acres were used for dryland crop production, or a total of 4,655,758 acres of cropland. Total applied water was 15,671,799 acre-feet, which results in an average applied water figure of 3.45 acre-feet. The total surface water used was 8,378,899 acre-feet and groundwater used was 7,292,000 acre-feet.

These predictions compare well with other reported land and water use figures for the period. DWR land use surveys for the period indicate a total irrigated acreage of 5,350,000 for the San Joaquin and Tulare Hydrologic Study Areas (HSAs). If the San Joaquin HSA figure is adjusted so that San Joaquin County irrigated acreage and that part of the Sacramento County irrigated acreage which is in the HSA are excluded from the figure (the resulting area is approximately the model study area) the irrigated acreage figure is approximately 4,535,000 acres. The average applied water figure of 3.45 also compares favorably to the 3.42 figure calculated from the weighted acreage figures reported in the Giannini Foundation Bulletin entitled "Agriculture Water Use and Costs in California." It was hard to get an accurate estimation of actual DAU water use by source for this period and after trying to calculate a reasonable estimate the effort was aborted. Table 4-9 shows the total water used by each DAU in the SJVPM 1978 base period run.

Table 4.7 shows distribution of crops by DAU predicted by the SJVPM. Table 4-8 shows how the model results compare with those estimated by the Agricultural Commissioner and the California Crop and Livestock and Reporting Service. For the most part the model's results compare well with those published by the two sources mentioned above. The widest discrepancies occur in the perennial acreages. Some of this discrepancy is due to the fact that only the Agricultural Commissioner reports published perennial acreage on a county-by-county basis and the reports for Fresno, Merced and Tulare Counties do not contain non-bearing acreage. Additionally, non-bearing acreage predicted by the SJVPM is in reality replacement acreage. The model assumes that an equilibrium exists and that a certain amount of perennials are planted to replace an equal amount going out of production due to loss of productivity. For example, for every acreage of bearing almonds in the model solution, 0.14 acre of non-bearing is being grown. This model assumption is realistic for every perennial but one, pistachios. For pistachios, the model does not

TABLE 4-7

RESULTS OF SJV PROGRAMMING MODEL

CROP ACREAGE BY DAU

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,685.0	0.0	0.0	6,010.0	831.0	0.0
207	1,766.0	15,513.0	0.0	0.0	0.0	0.0
208	3,756.0	0.0	0.0	0.0	0.0	210.0
209	3,451.0	30,630.0	0.0	0.0	1,230.0	0.0
210	3,204.0	11,908.5	0.0	6,130.0	0.0	0.0
211	2,470.0	8,415.0	0.0	0.0	0.0	0.0
212	5,409.0	0.0	0.0	1,330.0	1,630.0	5,350.0
213	6,494.0	7,834.0	4,000.0	0.0	0.0	320.0
214	10,955.0	19,955.0	0.0	0.0	0.0	0.0
215	7,527.0	8,119.0	6,500.0	0.0	698.0	4,195.0
216	7,613.0	0.0	0.0	2,040.0	1,840.0	9,580.0
233	0.0	4,069.0	0.0	253.0	0.0	0.0
234	1,500.0	1,800.0	0.0	0.0	0.0	0.0
235	0.0	9,649.0	0.0	0.0	0.0	1,839.0
236	1,744.0	0.0	0.0	0.0	0.0	0.0
237	2,488.0	28,310.0	0.0	0.0	1,977.0	2,770.0
238	2,814.0	17,326.0	0.0	545.0	6,600.0	540.0
239	2,674.0	10,000.0	0.0	0.0	1,808.0	935.0
240	1,109.0	500.0	0.0	0.0	0.0	0.0
241	7,686.0	58,044.0	0.0	290.0	700.0	6,838.0
242	7,412.0	45,273.0	0.0	905.0	13,455.0	1,910.0
243	14,500.0	40,000.0	0.0	3,170.0	15,020.0	1,175.0
244	6,390.0	104,403.0	0.0	0.0	0.0	7,228.0
245	2,627.0	15,645.0	0.0	0.0	0.0	0.0
246	2,858.0	16,726.0	0.0	0.0	0.0	0.0
254	20,070.0	0.0	0.0	1,650.0	0.0	1,575.0
255	0.0	17,040.0	0.0	0.0	5,553.0	3,150.0
256	12,000.0	0.0	0.0	0.0	8,500.0	630.0
257	2,539.0	25,000.0	0.0	0.0	0.0	0.0
258	0.0	4,400.0	0.0	0.0	0.0	1,000.0
259	0.0	25,834.0	0.0	0.0	0.0	0.0
260	0.0	160.0	0.0	0.0	0.0	4,500.0
261	0.0	6,936.7	0.0	0.0	0.0	1,060.0

RESULTS OF SJV PROGRAMMING MODEL
(CONTINUED)
CROP ACREAGE BY DAU

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	46,640.0	0.0	21,262.0	0.0	3,040.0
207	0.0	4,020.0	0.0	298.0	0.0	0.0
208	0.0	25,400.0	0.0	35,880.0	4,300.0	16,860.0
209	0.0	9,440.0	0.0	2,668.0	3,340.0	790.0
210	0.0	29,700.0	22,870.0	8,828.0	1,640.0	6,740.0
211	0.0	5,650.0	0.0	570.0	0.0	180.0
212	500.0	30,140.0	0.0	13,220.0	1,810.0	14,390.0
213	0.0	10,413.6	37,995.0	9,500.0	1,520.0	17,295.0
214	0.0	5,620.0	3,535.0	2,645.0	1,025.0	500.0
215	0.0	22,430.0	24,650.0	4,110.0	2,265.0	27,205.0
216	500.0	25,280.0	47,630.0	24,626.0	29,310.0	35,500.0
233	0.0	12,672.0	27,951.0	4,222.0	886.0	9,277.0
234	0.0	2,200.0	0.0	670.0	0.0	0.0
235	0.0	3,198.0	44,700.0	6,147.0	2,039.0	30,755.0
236	0.0	1,551.2	3,907.0	924.0	546.0	2,396.0
237	1,327.0	3,607.0	61,015.0	8,673.0	995.0	32,242.0
238	3,700.0	0.0	72,820.0	7,170.0	0.0	19,585.0
239	0.0	5,246.0	14,437.0	3,035.0	668.0	6,971.0
240	0.0	572.0	682.0	0.0	0.0	159.0
241	22,500.0	0.0	130,030.0	2,430.0	0.0	1,995.0
242	0.0	0.0	116,110.0	17,530.0	4,540.0	42,195.0
243	0.0	0.0	102,845.0	8,340.0	12,745.0	26,100.0
244	19,667.0	0.0	260,794.0	0.0	4,317.0	26,245.0
245	3,793.0	0.0	14,395.0	500.0	0.0	4,062.0
246	0.0	0.0	4,210.0	0.0	1,815.0	500.0
254	3,280.0	0.0	120,170.0	7,100.0	0.0	33,750.0
255	0.0	0.0	94,680.0	0.0	0.0	32,400.0
256	0.0	0.0	64,710.0	3,090.0	0.0	16,700.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	24,210.0	620.0	0.0	3,460.0
259	0.0	0.0	64,670.0	0.0	0.0	1,850.0
260	0.0	0.0	1,230.0	0.0	0.0	500.0
261	180.0	0.0	46,450.0	0.0	0.0	860.0

RESULTS OF SJV PROGRAMMING MODEL
(CONTINUED)
CROP ACREAGE BY DAU

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	900.0	0.0	300.0	370.0	300.0	11,730.0
233	500.0	0.0	200.0	250.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	300.0	0.0	150.0	150.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	500.0	1,050.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	900.0	0.0	200.0	300.0	1,100.0	900.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	985.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	3,530.0	0.0	0.0	2,200.0	0.0
259	0.0	3,250.0	0.0	0.0	630.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	3,530.0	0.0	0.0	500.0	0.0

RESULTS OF SJV PROGRAMMING MODEL
(CONTINUED)
CROP ACREAGE BY DAU

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,600.0	0.0	0.0	0.0	500.0
211	0.0	0.0	0.0	0.0	0.0	250.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	2,701.0	6,500.0	2,400.0	1,000.0	2,700.0	0.0
233	600.0	1,655.0	800.0	0.0	0.0	250.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,120.0	0.0	0.0	0.0	250.0
236	399.0	0.0	1,000.0	0.0	0.0	195.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,544.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	1,855.0	0.0	0.0	0.0	450.0
244	2,950.0	8,774.0	500.0	500.0	1,200.0	205.0
245	500.0	2,500.0	500.0	0.0	0.0	200.0
246	315.0	0.0	0.0	150.0	150.0	0.0
254	485.0	0.0	800.0	0.0	0.0	0.0
255	0.0	0.0	3,000.0	0.0	0.0	0.0
256	0.0	0.0	2,450.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	500.0	2,500.0	0.0	0.0	0.0	0.0
259	3,750.0	2,220.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	4,530.0	4,610.0	3,900.0	0.0	0.0	0.0

RESULTS OF SJV PROGRAMMING MODEL
(CONTINUED)
CROP ACREAGE BY DAU

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,170.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	6,630.0	0.0	672.0	2,468.0
211	0.0	0.0	0.0	0.0	460.0	0.0
212	0.0	0.0	0.0	0.0	3,570.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	1,085.0
215	0.0	0.0	0.0	0.0	0.0	2,900.0
216	0.0	0.0	0.0	1,000.0	2,360.0	8,750.0
233	0.0	0.0	0.0	0.0	212.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	542.0	0.0
236	0.0	0.0	300.0	800.0	138.0	2,225.0
237	0.0	0.0	0.0	0.0	443.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	150.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	100.0	1,285.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	900.0	1,824.0	29,420.0
245	0.0	0.0	0.0	0.0	0.0	1,030.0
246	0.0	0.0	0.0	0.0	0.0	1,105.0
254	100.0	1,830.0	0.0	0.0	0.0	1,400.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	160.0	3,030.0	0.0	0.0	0.0	2,300.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	750.0	18,100.0	0.0	0.0	0.0	3,100.0
259	0.0	0.0	0.0	0.0	0.0	1,400.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	250.0	660.0	0.0	0.0	0.0	2,300.0

RESULTS OF SJV PROGRAMMING MODEL
(CONTINUED)
CROP ACREAGE BY DAU

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	14,640.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,430.0	0.0	0.0	0.0	0.0	0.0	0.0
208	30,100.0	0.0	0.0	0.0	0.0	0.0	0.0
209	15,780.0	580.0	1,160.0	0.0	0.0	0.0	0.0
210	22,620.0	0.0	0.0	0.0	0.0	930.0	0.0
211	1,560.0	0.0	0.0	0.0	0.0	0.0	0.0
212	4,340.0	0.0	0.0	0.0	0.0	0.0	0.0
213	14,715.0	0.0	0.0	0.0	0.0	870.0	0.0
214	5,840.0	0.0	0.0	0.0	0.0	3,430.0	0.0
215	1,545.0	0.0	0.0	0.0	0.0	0.0	0.0
216	7,830.0	0.0	0.0	9,100.0	0.0	0.0	0.0
233	8,985.0	0.0	0.0	0.0	0.0	4,448.0	0.0
234	1,053.0	0.0	0.0	0.0	0.0	740.0	0.0
235	4,113.0	0.0	0.0	0.0	0.0	0.0	0.0
236	3,937.0	0.0	0.0	0.0	0.0	0.0	0.0
237	1,917.0	0.0	0.0	0.0	0.0	0.0	0.0
238	175.0	0.0	0.0	0.0	0.0	0.0	0.0
239	943.0	0.0	0.0	0.0	0.0	0.0	0.0
240	440.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	950.0	0.0	0.0
243	7,165.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,437.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,510.0	0.0	0.0	2,641.0	0.0	0.0	0.0
254	1,800.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,410.0	0.0	0.0	0.0	0.0	0.0	0.0
256	29,700.0	590.0	410.0	0.0	0.0	1,300.0	0.0
257	11,090.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,100.0	0.0	0.0	0.0	0.0	650.0	0.0
259	16,300.0	0.0	0.0	0.0	0.0	0.0	0.0
260	500.0	0.0	0.0	0.0	0.0	0.0	0.0
261	680.0	0.0	0.0	0.0	0.0	0.0	900.0

RESULTS OF SJV PROGRAMMING MODEL
(CONTINUED)
CROP ACREAGE BY DAU

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,462.0	0.0	10,000.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,305.0	0.0	11,255.0	0.0	0.0	0.0	0.0
209	2,174.0	0.0	8,696.0	0.0	0.0	0.0	0.0
210	8,690.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	3,670.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	33,654.0	10,000.0	0.0	0.0	0.0	550.0
214	0.0	4,224.0	20,000.0	0.0	0.0	0.0	1,200.0
215	0.0	4,614.0	14,350.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	42,779.0	0.0	170.0	174.0	2,691.0	2,600.0
234	0.0	939.0	0.0	0.0	0.0	0.0	0.0
235	0.0	16,663.0	0.0	0.0	0.0	0.0	0.0
236	0.0	99,203.0	0.0	0.0	0.0	5,734.0	0.0
237	0.0	5,969.0	0.0	0.0	0.0	0.0	0.0
238	200.0	1,200.0	757.0	0.0	0.0	280.0	0.0
239	4,348.0	5,714.0	10,895.0	0.0	0.0	3,133.0	1,500.0
240	4,348.0	1,000.0	5,585.0	200.0	303.0	382.0	4,800.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	3,167.0	14,768.0	51,815.0	400.0	711.0	1,317.0	7,864.0
243	15,092.0	0.0	0.0	400.0	744.0	0.0	1,585.0
244	5,799.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	883.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	337.4
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	195.0	16,509.0	751.0	0.0	0.0	0.0	0.0
256	5,109.0	0.0	21,506.0	200.0	612.0	500.0	0.0
257	467.0	0.0	0.0	400.0	904.0	0.0	0.0
258	4,138.0	0.0	0.0	200.0	469.0	0.0	0.0
259	995.0	0.0	20,627.0	0.0	0.0	0.0	2,700.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	464.0	0.0	0.0	316.0	1,136.0	0.0	0.0

RESULTS OF SJV PROGRAMMING MODEL
(CONTINUED)
CROP ACREAGE BY DAU

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	5,910.0	0.0	0.0	0.0	12,620.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	7,230.0	0.0	0.0	0.0	5,500.0
209	0.0	0.0	2,200.0	0.0	0.0	0.0	620.0
210	0.0	0.0	8,220.0	0.0	0.0	0.0	500.0
211	0.0	0.0	0.0	445.0	0.0	0.0	0.0
212	0.0	0.0	0.0	445.0	0.0	0.0	0.0
213	0.0	0.0	2,110.0	0.0	855.0	0.0	885.0
214	2,850.0	100.0	440.0	1,030.0	0.0	0.0	615.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,370.0	0.0	0.0	0.0	6,900.0
233	2,378.0	851.0	1,695.0	202.0	2,000.0	1,000.0	2,691.0
234	1,355.0	628.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,636.0	0.0	0.0	0.0	0.0
236	352.0	210.0	4,234.0	202.0	2,700.0	0.0	6,064.0
237	0.0	0.0	0.0	0.0	0.0	0.0	780.0
238	0.0	0.0	600.0	0.0	1,000.0	0.0	4,280.0
239	3,835.0	1,511.0	4,796.0	0.0	8,010.0	0.0	0.0
240	10,573.0	4,434.0	726.0	0.0	803.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	35,186.0	14,930.0	1,000.0	0.0	4,800.0	3,082.0	19,970.0
243	13,102.0	5,603.0	0.0	710.0	2,657.0	1,404.0	7,220.0
244	0.0	0.0	0.0	287.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	375.0	260.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	6,500.0	3,800.0	915.0	835.0	1,000.0	0.0	430.0
257	6,182.0	3,363.0	0.0	0.0	0.0	0.0	0.0
258	3,080.0	1,820.0	900.0	1,050.0	920.0	0.0	200.0
259	980.0	437.0	0.0	1,077.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	966.0	414.0	810.0	0.0	0.0	0.0	0.0

TABLE 4-8

SAN JOAQUIN VALLEY ACREAGE COMPARISONS

CROP	PREDICTED 1978 ACREAGE	AG.COMM. REPORTED 1978 ACREAGE	CCLRS REPORTED 1978 ACREAGE
WHEAT	143,741.0	116,424	168,000
BARLEY	533,490.1	523,400	533,500
OATS	10,500.0	12,450	N/A
RICE	22,323.0	36,376	31,300
SORGHUM	59,842.0	56,300	78,200
SUGAR BEETS	54,805.0	53,105	46,814
SAFFLOWER	55,447.0	54,663	N/A
IRRIGATED PASTURE	243,779.8	298,600	N/A
COTTON	1,406,696.0	1,401,745	1,366,000
CORN	194,058.0	197,740	157,300
DRY BEANS	73,761.0	71,769	N/A
ALFALFA	414,502.0	403,400	N/A
SNAPBEANS	2,600.0	3,324	300
CARROTS	11,295.0	11,580	11,530
CAULIFLOWER	3,470.0	2,970	3,470
GARLIC	4,730.0	5,230	5,230
LIMA BEANS	12,630.0	13,680	14,750
LETTUCE	16,730.0	17,021	16,000
MELONS (CANTALOUPS)	35,878.0	37,345	33,970
ONIONS	15,350.0	15,651	15,370
PEAS	5,700.0	6,525	5,300
GREEN PEPPERS	2,300.0	1,478	1,560
POTATOES	26,265.0	23,535	28,000
SWEET POTATOES	8,100.0	8,230	8,250
SPINACH	2,700.0	2,490	3,080
FRESH TOMATOES	10,371.0	10,087	9,500
PROCESSING TOMATOES	59,483.0	58,798	56,760
ALMONDS	228,655.0	197,096	
APPLES	2,740.0	1,882	
APRICOTS	11,741.0	11,763	
AVODADOS	950.0	951	
FIGS	12,368.0	16,737	
GRAPEFRUIT	1,500.0	2,234	
GRAPES	496,979.0	435,572	
LEMONS	7,339.0	8,790	
NECTARINES	14,037.0	15,120	
OLIVES	23,860.7	26,872	
ORANGES	126,075.0	126,243	
PEACHES	45,792.0	43,448	
PISTACHIOS	6,283.0	70,013	
PLUMS	24,745.0	26,157	
PRUNES	5,486.0	6,108	
WALNUTS	69,275.0	71,531	

NOTE: NON-BEARING ACREAGE IN FRESNO, MERCED, AND TULARE COUNTIES NOT INCLUDED IN AG. COMMISSIONER REPORTS FOR 1978.

TABLE 4-9
APPLIED WATER
SAN JOAQUIN VALLEY PRODUCTION MODEL
1978

DAU	APPLIED WATER - 1978
206	631591.0
202	34181.0
208	586071.0
209	212157.0
210	613700.0
211	52327.0
212	387225.0
213	634616.0
214	188818.0
215	518651.0
216	925752.0
233	535121.0
234	30512.0
235	494833.0
236	542223.0
237	555670.0
238	490936.0
239	338475.0
240	113401.0
241	731453.0
242	1403312.0
243	828177.0
244	1493282.0
245	122498.0
246	74977.0
254	717492.0
255	688057.0
256	642323.0
257	78916.0
258	235242.0
259	435978.0
260	25490.0
261	250852.0

capture the large amount of investment made by pistachio growers in anticipation of a large demand for the commodity.

These results indicate that the model's performance is good. Both total production and total resource use are close to what occurred in the 1978 base period. This indicates that the yield, applied water coefficients, and crop acreage figures are close to the 1978 actuals.

At this point, two suggestions are proposed to make the SJVPM a "better" model. The first suggestion has to do with data set. As it now exists, the data set has average yield data for two soil types and homogeneous production cost (except for water cost) data. These data need to be more finely disaggregated. This could be accomplished by collecting more soil and yield data than was possible in this study, and by having someone collect good input price and input combination data. It should be noted that both of these tasks will require a substantial amount of time and personnel to accomplish.

The second suggestion has to do with model specification. Currently, the SJVPM is specified as an asymmetric production model. That is, crop demand functions are explicitly represented in the model's objective function; however, the cost function for producing a crop commodity is represented by a single value or average cost per unit figure. Since there is assumed to be a wide variability in the yields of different crops on different soils, then it follows that the cost function is probably non-linear. The SJVPM as currently structured can be set up to handle a non-linear cost function and hence become a symmetric production model. However, it should be noted that this requires the estimation of the non-linear cost functions and the respecification of the SJVPM objective function. Both of these items are applied research topics but they would substantially improve this or any production model's performance.

5. THE LINEAR QUADRATIC CONTROL MODEL

5.1 THE SAN JOAQUIN VALLEY CONTROL MODEL

The Linear Quadratic Control Model (LQCM) is an intertemporal optimization model. The role of the LQCM is to solve the dynamic economic problem of allocating resources among competing uses over an interval of time in such as way as to maximize a chosen objective function. A mathematical statement of the problem is that of choosing time paths for certain variables, called control variables. The choice of time paths for the control variables implies via a set of differential equations,called equations of motion, time paths for certain variables describing the system, called state variables and the time paths of the control variables are chosen so as to maximize a given functional depending on the time paths for the control and state variables,called the objective functional.

The Linear Quadratic Control Model used for determining the intertemporal allocations of groundwater in the San Joaquin Valley can be represented as follows:

$$\text{Max } J = \sum_{t=0}^{T-1} (1+r)^{-t} \, (RR_t u_t - 1/2 \, u_t{}' R_t u_t - a_t u_t - y_t K_t u_t)$$

$$\text{subject to:} \quad y_{t+1} = Ay_t + Cu_t + Cx_t + D$$

RR_t is a 32 X I time varying vector of groundwater demand intercepts, R_t is a 32 X 32 time varying matrix of groundwater demand slopes, a_t is a 32 X 1 time varying vector of pumping cost function intercepts. K_t is a 32 X 32 time varying matrix of pumping cost function slopes, u_t is a 32 X I time varying vector of groundwater pumpages (controls) and y_t is a 32 X I time varying vector of groundwater pumping depths (states). The elements of the matrices and vectors are in numerical order of the DAU's. That is, the first element in each matrix or vector represents DAU 206 and the last represents DAU 261.

The matrices A, B and C and the Vector D are the equation of motions matrices. A is 32 X 32 time invariant matrix which related future pumping depths to past pumping depths. B is a 32 X 32 time invariant matrix which relates past

pumpage to future pumping depth and C is a 32 X 32 time invariant matrix that relates past recharge to future pumping depths. D is an intercept term that results from the linearization of a non-linear hydrologic system. Finally x_t is 40 X 32 time varying vector of groundwater recharge.

The welfare function (objective functional = J) is an explcit measure of the value of groundwater. This welfare measure is discounted by the term $(1+r)^{-t}$ where r was set at four percent for this study. Four percent is approximately what the long-run real interest rate has been over the past 20 years and was felt that it was an adequate measure of the social discount rate. The welfare function is composed of two parts. The first part is the term $RR_t u_t - 1/2\ u_t R_t u_t$. This part meaasures the value of groundwater in crop production in any time period t. It is obtained from the estimated groundwater demand functions discussed in Chapter 4 with RR = a, R = b, and u = Q. The second part of the welfare function $-au_t - y_t\ K_t\ u_t$ measures the cost of extracting a unit of groundwater from storage at a specific depth. Note the relationship of these two components. The value component relates to the value of the pumped water and increases at a diminishing rate with increased pumpage; however, as pumpage increases pumping depths increase and the cost component increases at an increasing rate.

The constraint set on this maximization problem is the equation of motion which in this case is a set of hydrologic relationships which relate future pumping lifts to past lifts, past recharge and past pumpage. The three matrices (A, B, C) which interrelate the different variables have not only diagonal but off-diagonal elements. This allows for the model to take account of the hydrologic and consequently economic interrelationships that occur between the different DAU's making up the San Joaquin Valley.

Thus, the LQCM derives the DAU pumpage rates which maximize the welfare function based on groundwater demand functions derived from the San Joaquin valley Production Model (SJVPM) and on groundwater pumping costs. The hydrologic variables appearing in the performance index are the total DAU pumpage and the average DAU pumping lift for each year. The average lift is a lumped measure of pumping lift from both aquifers. The LQCM performance index is maximized subject to a set of contraint equations which explicitly state

the relationship between pumpage, recharge, and average lift in each DAU.

There are at present two methods for solving this problem. First, it is possible given this problem's specification to use the mathematical solution as the basis for a computer algorithm to solve it. Such an algorithm has been written. It is called ICON, short for Interactive Control Algorithm. The algorithm's use and a test of its ability are provided in the ICON Users' Manual. The second method is to set the problem up as a mathematical programming problem. No facility for such an approach has been provided for in this project.

5.2 ESTIMATION OF THE EQUATIONS OF MOTION

When considered from an economic point of view, the hydrologic phenomena simulated by the San Joaquin Valley groundwater model act as constraints on the exploitation of the Valley's groundwater resources. These constraints insure, for example, that if pumpage consistently exceeds the sum of recharge and subsurface inflow, pumping depths will increase and groundwater costs will rise. The LQCM attempts to identify the proper economic balance between the advantages obtained from pumping more groundwater and the costs incurred by pumping from greater depths.

As previously stated, these constraints are in the form of difference equations which are called equations of motion. In principle, the equations of motion could be obtained directly from the discretized finite element groundwater equations used in GWM. This is not practical in the San Joaquin application because GWM's multi-layered element-oriented equations are too numerous and too complex to be readily incorporated into LQCM solution procedure. Besides, the DAU level economic information included in the LQCM performance index is too aggregated to benefit from the additional spatial detail provided by the GWM equations.

For scenario purposes it is reasonable to use a simplified set of groundwater equations which are written entirely in terms of DAU level variables. A typical example is the following linear equation for pumping lift in DAU 206:

$$
\begin{aligned}
y_{206}(t_n) = {} & a_1 y_{206}(t_0) + a_2 y_{207}(t_0) \\
& + b_1 u_{206}(t_0) + b_2 u_{207}(t_0) \qquad (5\text{-}1) \\
& + c_1 x_{206}(t_0) + c_2 x_{207}(t_0) + d
\end{aligned}
$$

The variables appearing in this equation are defined as follows:

$y_{206}(t_0), y_{207}(t_0)$ = average pumping lifts for DAUs 206 and 207 at a previous time t_0 (feet)

$y_{206}(t_n)$ = average pumping lift for DAU 206 at a new time t_n (feet)

$u_{206}(t_0), u_{207}(t_0)$ = total pumpage for DAUs 206 and 207 at time t_0 (thousands of acre feet per year)

$x_{206}(t_0), x207(t_0)$ = total recharge for DAUs 206 and 207 at time t_0 (thousands of acre feet per year)

$a_1, a_2, b_1, b_2, c_1, c_2$ = unknown coefficients relating the independent variables on the right hand-side of Equation 5-1 to the dependent variable $L_{206}(t_n)$

d = linear intercept term

The San Joaquin Valley LQCM contains 32 constraint equations having the general form of Equation 5-1, one equation for each DAU. The unknown coefficients of these equations can be viewed as sensitivity derivatives which specify the effect that each independent variable has on each DAU's lift. The "cross coefficients" such as a_2, b_2 and c_2 account for subsurface interactions between neighboring DAUs while the "diagonal coefficients" such as a_1, b_1, and c_1 account for temporal correlations within a single DAU.

These coefficients then become part of the A, B, and C matrices, and the D vector described earlier.

The equations of motion coefficients are difficult to specify a priori but can be estimated statistically from long sequences of simulated pumpage, recharge, and lift.

The easiest way to generate the long hydrologic sequences required for LQCM estimation is to compute the lifts directly from a GWM simulation driven by randomly fluctuating pumpage and recharge. If the pumpage and recharge values vary enough, this approach will produce a lift sequence which will cover the range of hydrologic conditions likely to be encountered in a scenario simulation. The degree of variability required to obtain reliable coefficient estimates is difficult to specify before the scenario simulations are run. Obvious lower bounds on pumpage and recharge values are zero. Economically realistic upper bounds for pumpage are probably near the levels which occurred during the early seventies when energy costs were low and the groundwater basin was being heavily pumped. A similar argument applies to net recharge. Since the year-to-year variations may lie anywhere in the range between the lower and upper bounds, it is reasonable to draw the pumpage and recharge values for each year from a uniform random distribution. After some experimentation, the upper bounds on DAU pumpage and recharge were set at 130 percent of the 1970 water year values. The resulting random sequences exhibited a hydrologically plausible degree of variability.

The random pumpage and recharge values used in the long-term GWM simulation were produced with a random number generator included in the GWM program. Initial heads for the beginning of the first water year (1971) were obtained from the base period simulation described in Chapter 4. A 100-year sequence of data observations was developed using the above procedure. A maximum liklihood estimator was used to estimate the coefficients described above. The estimates produced by this algorithm are generally quite reasonable and give some valuable insight into he degree of interaction occuring betwen the DAUs. A detailed discussion and presentation of the results is presented in Noel (1982c).

5.3 PUMPING COST FUNCTIONS

The pumping cost functions make up one part of the LQCM maximand as briefly discussed in Section 5.1. These functions are represented by the $-a_{ut}-y_tK_tu_t$ term. This term is the cost of taking a specific amount of water from a specific depth and using it for crop production. The rate of change with respect to pumping depths of this function measures the additional cost of lowering the pumping depth one more foot. As such it can be used to measure, as previously stated, the future value of keeping the water in storage.

The pumping cost functions estimated for the 32 DAUs in the study area were intended to be long-run average total cost functions; that is, the pumping cost for any given DAU was assumed to be a function of pumping lift, pumping technology, and the cost of electricity per kilowatt-hour. In a long-run situation all these are considered as variable cost parameters while in the short run only the pumping lift and possibly the cost of electricity would be considered variable cost parameters.

The functional form used for estimation purposes can be expressed as

$$ATCAFI = a + Ky \qquad (5\text{-}2)$$

where ATCAFI is the average total pumping cost per acre-foot per foot of lift, a represents the portion of the average total cost attributable to the pumping plant technology, and Ky is the portion of the average total cost attributable to the lift and energy cost.

The data set necessary to estimate these functions requires knowledge about the average pumping plant technology in each of the 32 DAUs, and the kilowatt-hours required to lift an acre-foot of water from a specified depth. Since it was impossible to gather this data directly from groundwater users, assumptions were made about the average gallons per minute (GPM) pumped by an average pumping plant with an assumed efficiency. These assumptions were based on data obtained from DWR and from Table 1 in the first progress report on the San Joaquin Valley Groundwater Study (June 1980). The GPM figures

varied between 300 and 1400, with a mean of about 750 GPM. The pumping plant efficiencies were between 0.62 and 0.67, with a mean of 0.65. Knowing the GPM and pumping plant efficiency in each DAU allowed determination of the pumping plant technology for a set of pumping depths. It was then possible to calculate the cost per acre-foot for each lift's pumping technology.

The next step was to determine the cost per acre-foot associated with a specific pumping lift and specific energy cost. This was done by determining the kilowatt-hours required to lift an acre-foot of water from various depths in each of the 32 DAUs. Once this was detemined it was multiplied by the energy cost to give dollars of cost per acre-foot per foot of lift.

The final step involved summing the two cost components together to get an average total cost per acre-foot per foot of lift. These average total cost figures were then regressed against depth as specified by equation 5-2 to give the pumping cost function.

This average cost function can be turned into a total cost function by multiplying through by the pumpage. This results in a series of equations like

$$TC = au + uKy \qquad (5\text{-}3)$$

If these equations are specified over time then the result is that total pumping costs can be represented over a 40-year horizon by

$$TC = a_t u_t + u_t K_t y_t \qquad (5\text{-}4)$$

A more complete discussion of this pumping cost function estimation and the data set used to estimate it are contained in Noel (1982c).

CONCLUSION

The use of a the LQCM to determine optimal groundwater pumpage and pumping lifts over a selected time horizon is what separates this methodologic

approach to modeling groundwater allocation from others that have been done. Several points recommend the use of the LQCM for studying and making decisions in relation to water resource problems. First, it is dynamic since it uses all the available information about present and future water demand and costs to determine the optimal groundwater pumpage and pumping lifts given different water management scenarios. Second, the LQCM allows for a direct interaction of the physical and economic parameters which characterize the groundwater allocation decision. Finally, the use of the LQCM allows for direct estimation of the social cost of using the groundwater resource. This is the most important of the points for using the LQCM. The social cost measure the cost that the individual users of the groundwater force on each other spatially and intertemporally. These costs are significant because a unit of groundwater pumped today is not there to be pumped in the future, and therefore future costs rise as current groundwater pumping occurs. It is the lack of accountability of these costs by individual users that cause the divergence between private and social allocations of groundwater. Knowledge of these costs are very important to policy makers since only by knowing these costs and the costs of alternative groundwater management plans can the decision to have social intervention into the current allocative process be made.

6. THE HYDROLOGIC-ECONOMIC MODEL SYSTEM SCENARIO RUNS

6.1 INTRODUCTION

The preceding four chapters have described in detail the various models of the Hydrologic-Economic Model (HEM) system which is the major product of the San Joaquin groundwater modeling study. The historical simulations establish the credibility of SWAM, GWM, and the SJVPM. As previously stated, the HEM system was developed in order to enable policy makers and water users to see how the physical and economic parameters describing San Joaquin Valley agriculture would change under different water use scenarios. Using the HEM system to help measure the impacts of hypothetical problems based on future water use scenarios will help planners predict and possibly prevent serious water problems Valley residents could confront in the years ahead.

Two initial water use scenarios were proposed by DWR to test the proficiency of the HEM system. Each describes a hypothetical water use situation that HEM will evaluate in terms of overdraft, future cropping patterns, farm income, land use changes, and impact on pumpage and groundwater pumping depths in the Valley. These two scenarios were run assuming that spatial and temporal groundwater allocation should maximize the value of this resource to the benefit of society and not necessarily to the short-run benefit of agricultural water users in the Valley.

Many will regard this choice as non-realistic or "ivory tower" thinking. Nothing could be further from the truth. If a policy maker proposes to make changes in water institutions or policy in an effort to improve the economic value of the resource then there must exist an "ideal" that may or may not be obtainable given political or other social criteria but acts as a standard against which to compare the benefit or costs associated with the policy change. Otherwise, how can a decision maker know if the proposed change increases or lessens the current economic value of the resource. After all, it is possible given the costs, sometimes large, of changing existing institutions and policies that when all things are considered the status quo may be the "best" of all worlds.

6.2 DEFINITIONS OF THE STUDY SCENARIOS

Two water-use scenarios were developed for this study by DWR. Each describes a hypothetical water use situation which can be broadly defined as follows:

- -- Scenario I calls for the continued use of existing water resources in the Valley with no legal restrictions on groundwater pumping or land development. It assumes that farmers' surface water entitlements will be honored to the extent that agricultural expansion will continue to escalate, subject to economic conditions.

- -- Scenario II, utilizing assumptions in Scenario I, futher assumes that import facilities and surface deliveries are expanded according to SB-200.

Both scenarios extend over a 40-year period from 1981 to 2020. In order to make the scenario results as realistic as possible, DWR decided that the annual precipitation and streamflow values used in the scenarios should follow a historical pattern of climatic variations. One way to achieve this would be to simply extract 40-year precipitation and flow sequences from historical raingage and streamgage records for the San Joaquin Valley. The major disadvantage of this approach is that it requires the use of streamflow data collected prior to the 1950's, before many of the reservoirs now in place were constructed. These unimpaired streamflow data may differ significantly (particularly in extreme years) from the impaired flows which would occur if the climatic conditions of the 1940's and 1950's were repeated with existing reservoirs in place.

The unimpaired flow problem encountered with 40-years of historical data can be alleviated considerably if the 40 year scenario sequence is constructed from two copies of a single 20-year sequence placed back to back. A convenient 20-year period to use for this purpose is the one spanning water years 1958 through 1977. The 1958-1977 period is one which exhibits considerable hydrologic variability -- it includes some unusually wet years (1958, 1965 and 1969) as well as the severe 1976-1977 drought and yet provides average flows which are near long-term means in most of the Valley.

Annual DAU average precipitation and annual upstream channel flows for the 1958-1977 period were obtained, for the most part, from the same data sources used to obtain the base period hydrologic inputs discussed in McLaughlin (1982). In some cases, stream gage records had to be modified to account for the effects of reservoirs constructed after 1958. Modifications based on DWR reservoir operations studies were required during the indicated years for the following streams:

- Stanislaus River (1958-1977)
- Tuolumne River (1958-1972)
- Merced River (1958-1968)
- Chowchilla River (1958-1968)
- Fresno River (1958-1977)
- Kaweah River (1958-1961)
- Tule River (1958-1952)

Detailed information on the reservoir operations studies used to estimate impaired flows for these streams is not available in published form but can be found in project files at DWR's San Joaquin District Office. All DAU precipitation values and channel streamflow values for the 40-year scenario simulation period are listed in the SWAM input files provided in Appendices C and D of this final report.

Sections 6.2.1 and 6.2.2 contain general hydrologic consideration for the Central Valley Project (CVP) and State Water Project (SWP) for the two scenarios. A complete description of the hydrologic conditions underlying the two scenarios is included in McLaughlin (1982).

6.2.1 SCENARIO I CVP AND SWP INPUTS

The general hydrologic specifications assumed for Scenario I can be summarized as follows:

1. No new storage or transportation facilities affecting San Joaquin Valley water deliveries will be built over the 1980-2020 scenario period.

2. Entitlement for SWP water will build up as presently contracted until 1990.

3. The State Water Project will retain its current operating criteria over the scenario period.

These specifications affect the values assumed for upstream flows in SWAM channels delivering CVP or SWP water. Because operating policies differ it is easiest to treat the two sources of water separately. It should be remembered, however, that the actual flows in a few SWAM channels carrying both State and Federal water are obtained by summing CVP and SWP contributions. The locations of the channels referred to in the following discussion are shown in Figure 3-2. All channel flows for Scenario I are listed in the SWAM input file provided in Appendix C of this report.

6.2.2 SCENARIO II CVP AND SWP INPUTS

The hydrologic specifications for Scenario II can be summarized as follows:

1. All Senate Bill 200 storage and transportation facilities, including upstream reservoirs, the Peripheral Canal, and the Mid-Valley Canal will be constructed on schedule.

2. Entitlements for SWP water will build up as presently contracted.

3. Kern County and Southern California groundwater storage programs and a Colorado River water banking program will be initiated.

As in Scenario I, these specifications affect the values assumed for upstream flows in SWAM channels delivering CVP and SWP water.

6.3 RESULTS OF SCENARIO I

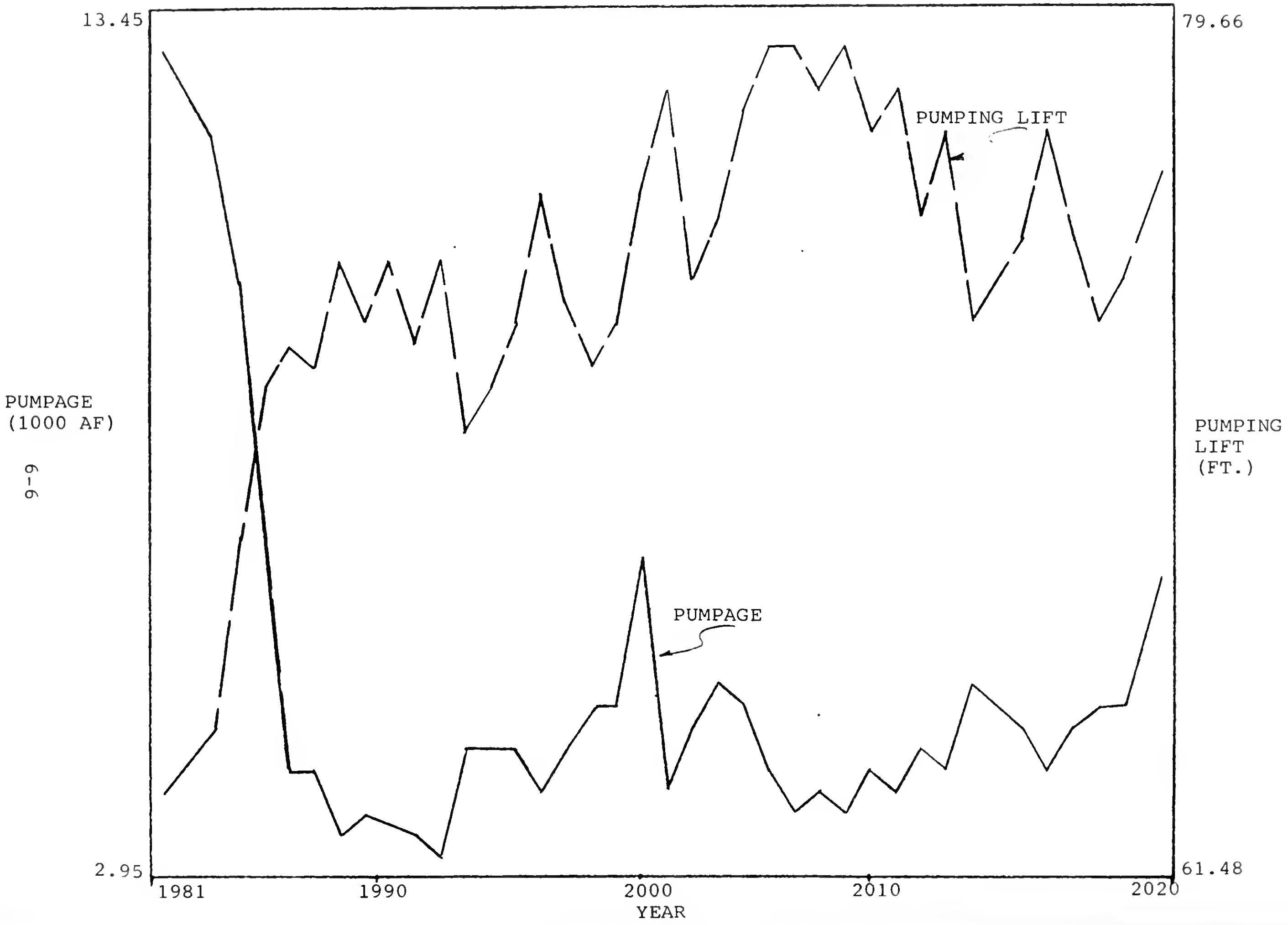
The results of Scenarios I and II are presented in Tables 6.1.1 through 6.4.5. (The tables appear at the end of this chapter). Tables 6.1.1 through Table 6.1.9 are the Linear Quadratic Control Model (LQCM) results for Scenario I for 1981, 1985, 1990, 1995, 2000, 2005, 2010, 2015, and 2020, respectively. These results show the pumpage, average DAU groundwater pumping depths, and social cost for 32 DAU's in the study area.

The differences that occured in groundwater pumping depths north to south are illustrated in Graphs 6.1.1 through 6.1.7. DAU 207 and 210 are northern DAU's which show fairly stable pumping depths although pumpages; especially in DAU 210, varies quite significantly. This is primarily due to the large fluctuations in surface water availabilities. The surface water availabilites are based on the two 20-year hydrologic sequences previously discussed. Thus, when looking at these graphs it should be kept in mind that the period of 1981-1990 represents a farily wet hydrologic sequence as does the period of 2005 to 2015. There are two drought periods in this hydrologic sequence, the years 2000 and 2020. Note that the groundwater pumpage declines and increases depending on whether it is a dry or wet hydrologic period which is what is to be expected.

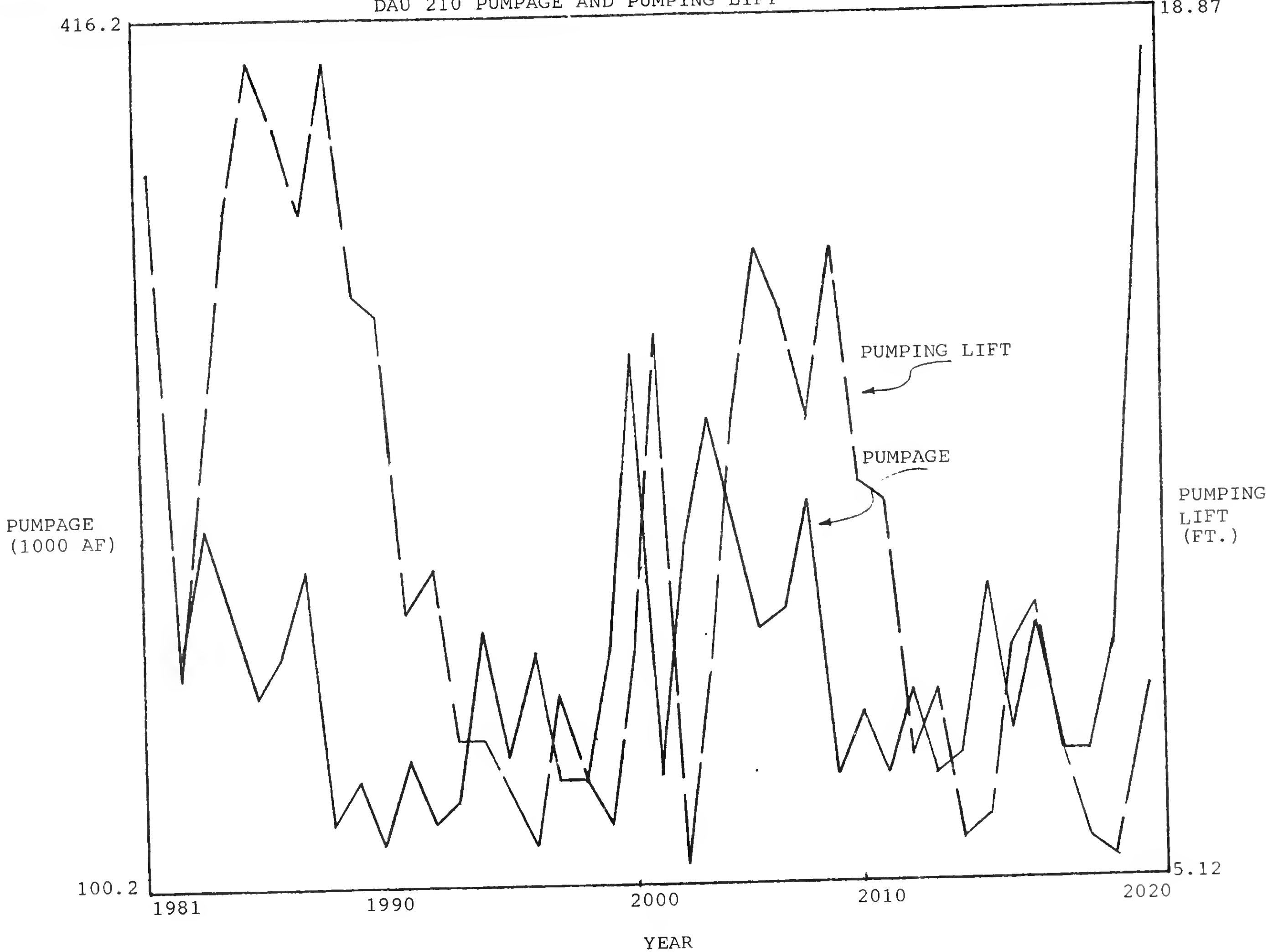
DAUs 234 and 242 are central eastern DAUs with DAU 234 being further north than DAU 242. DAU 234 represents a DAU that shows a decreasing pumping lift over time while DAU 242 shows an increasing pumping lift over time. DAU 244 is in the west central portion of the SJV and is the biggest DAU in the study area. This DAU's pumpage over the 40-years tends to be fairly stable and the pumping lifts decrease slightly over the 40 year sequence. DAU 244 is the Westlands Water District and the predicted results match well with what has happened in the Westlands since the arrival of a surface water supply.

DAUs 257 and DAU 261 are both in Kern County. DAU 257 is in eastern Kern and DAU 261 is western Kern. DAU 257 shows a decreasing pumping lift over time. This particular DAU has a very large surface water supply as compared to its groundwater usage which basically accounts for the rising pumping lift. DAU 261 shows the most dramatic increase of lifts over the 40-year period. This

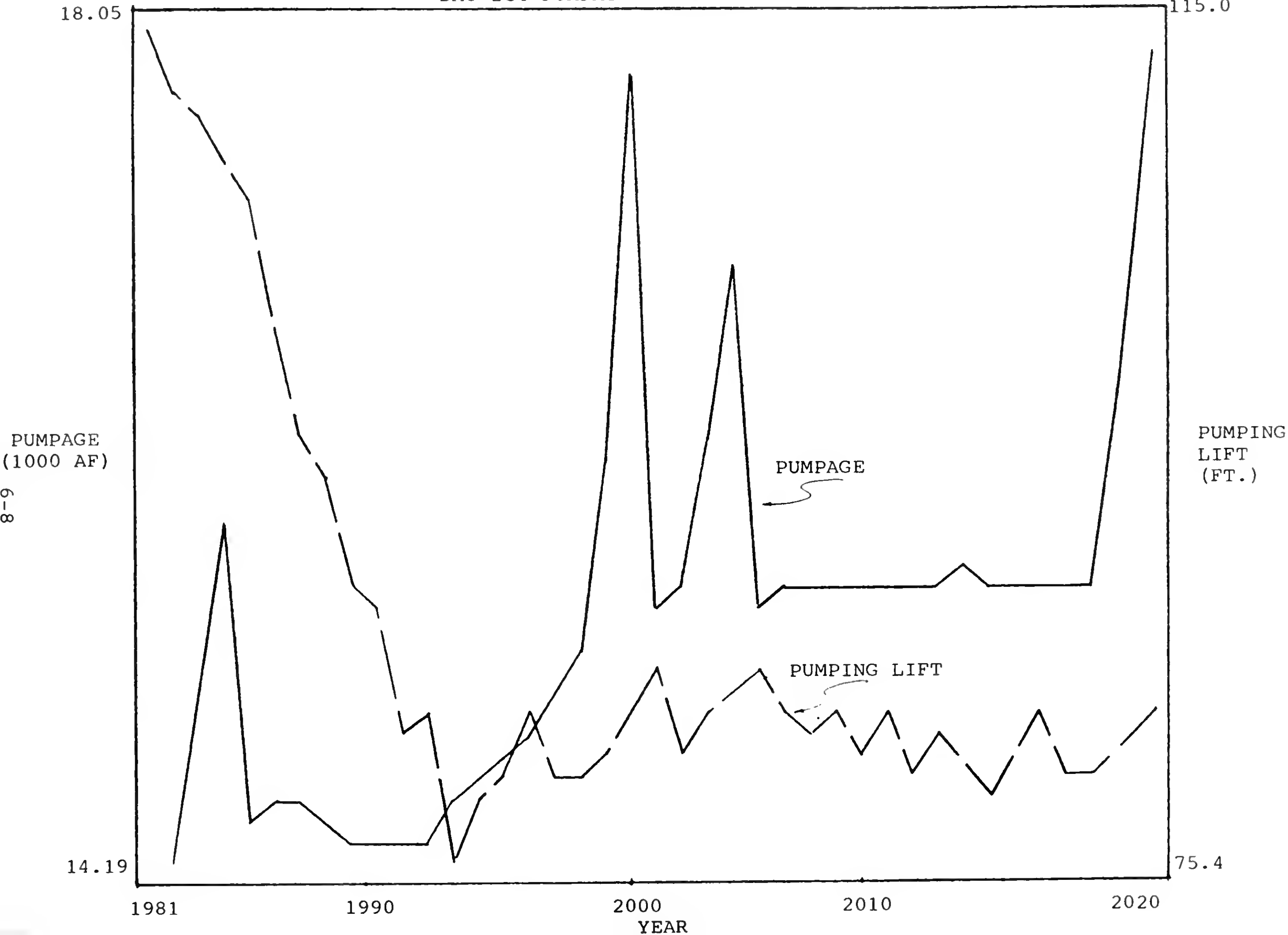
GRAPH 6.1.1
SCENARIO I
DAU 207 PUMPAGE AND PUMPING LIFT



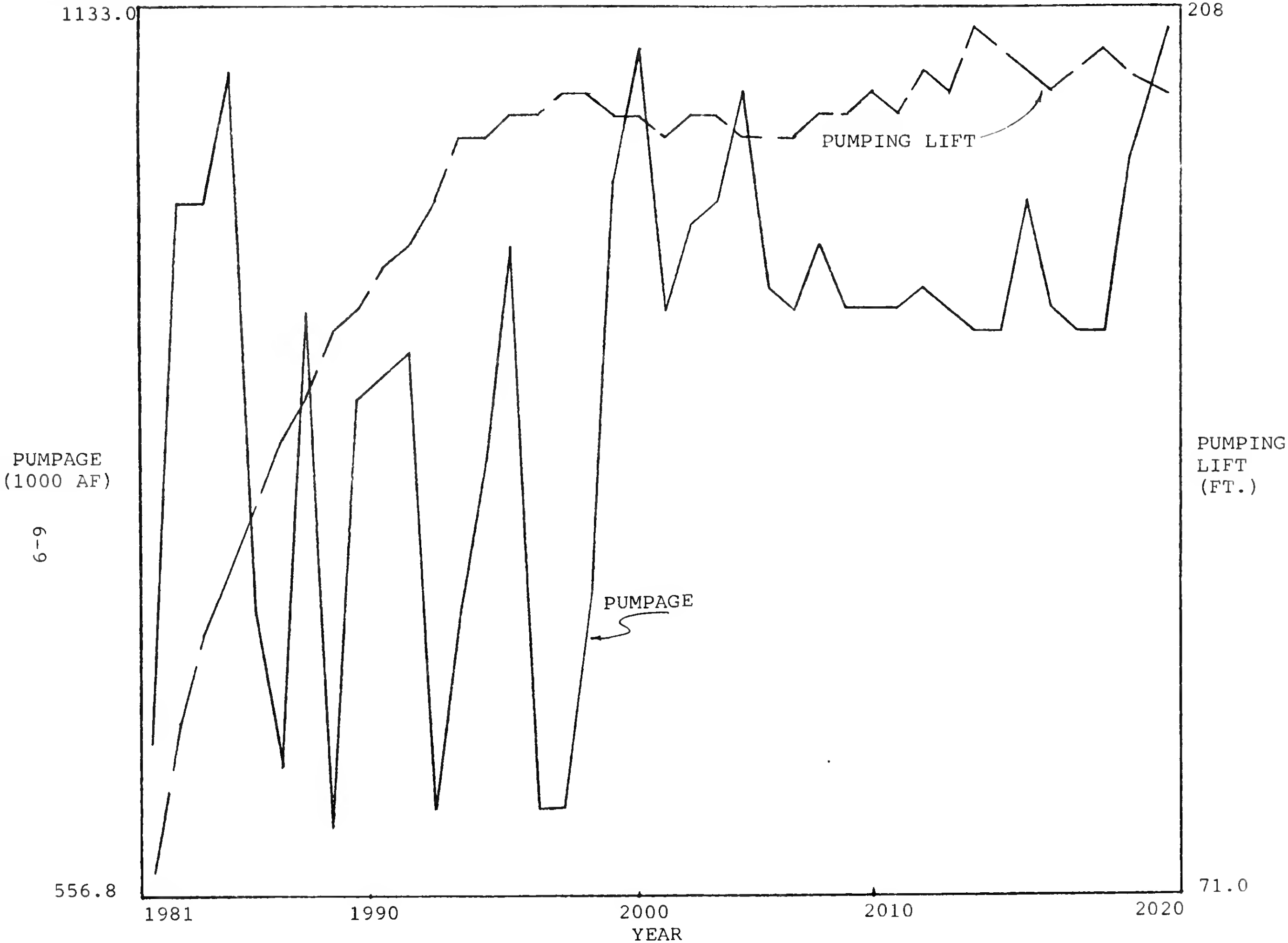
GRAPH 6.1.2
SCENARIO I
DAU 210 PUMPAGE AND PUMPING LIFT



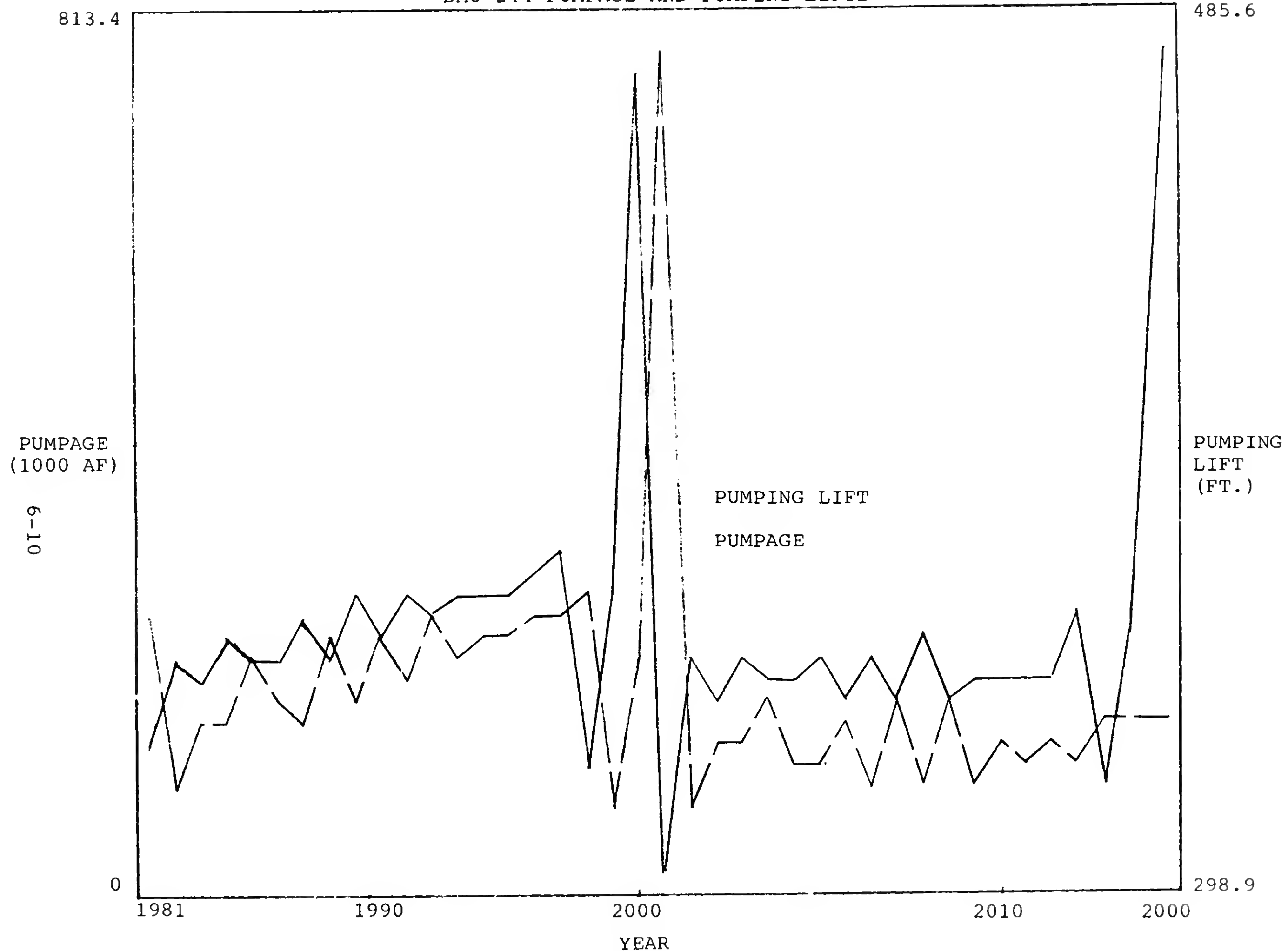
GRAPH 6.1.3
SCENARIO I
DAU 234 PUMPAGE AND PUMPING LIFT



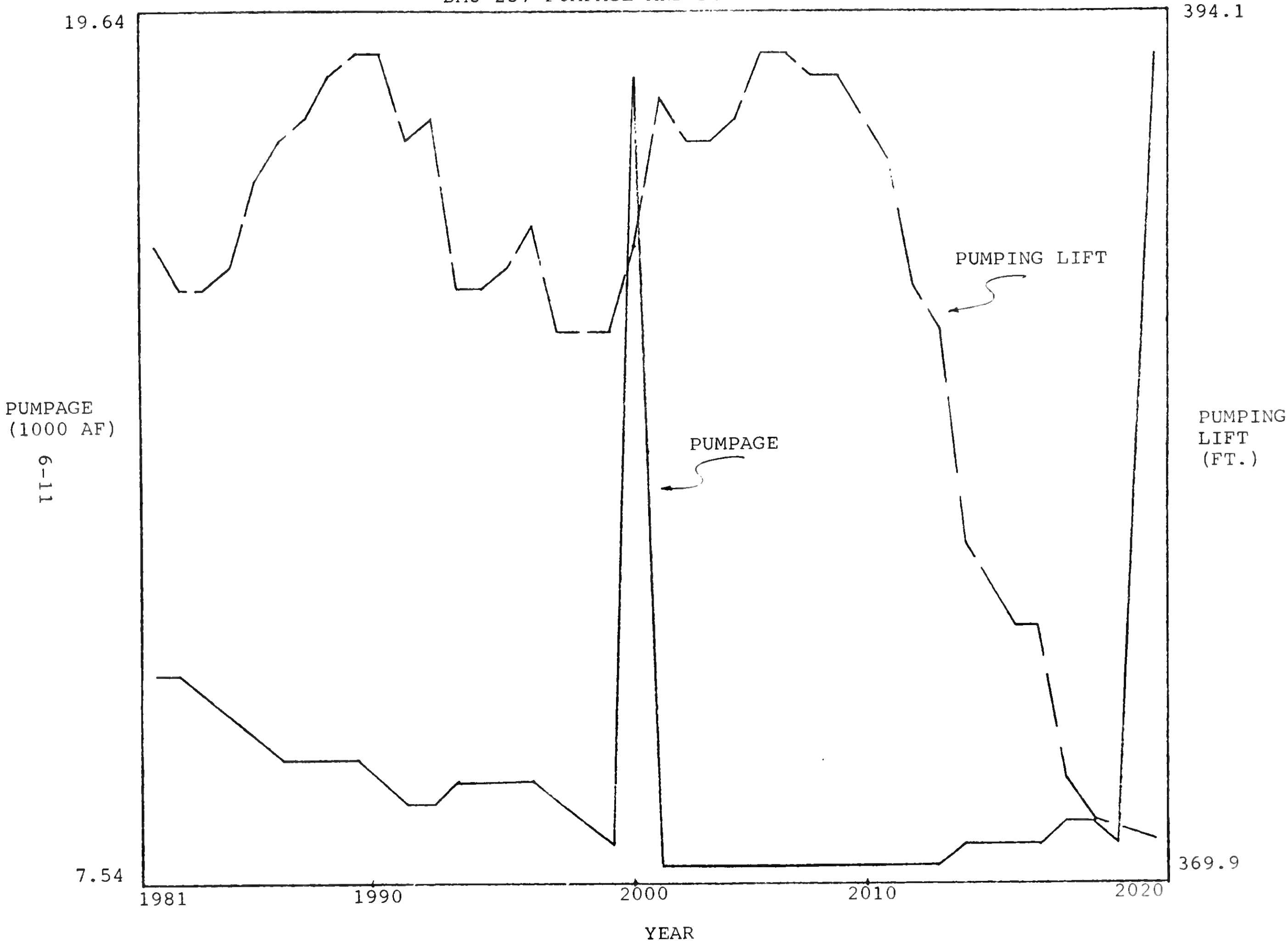
GRAPH 6.1.4
SCENARIO I
DAU 242 PUMPAGE AND PUMPING LIFTS



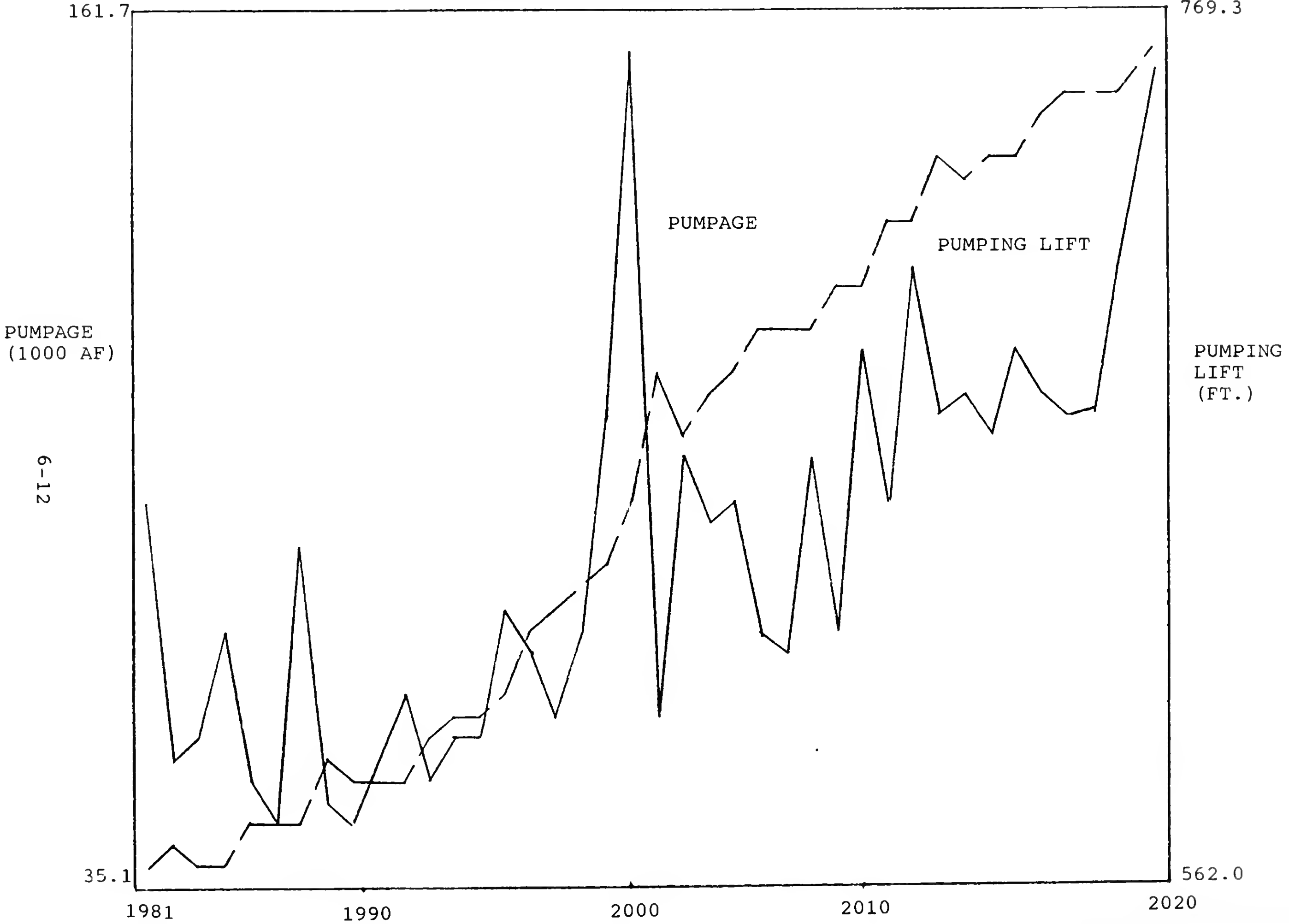
GRAPH 6.1.5
SCENARIO I
DAU 244 PUMPAGE AND PUMPING LIFTS



GRAPH 6.1.6
SCENARIO I
DAU 257 PUMPAGE AND PUMPING LIFT



GRAPH 6.1.7
SCENARIO II
DAU 261 PUMPAGE AND PUMPING LIFTS



indicates that even at comparatively low pumping levels groundwater overdraft is occurring.

These results are not suprising given the history of water development and use in the San Joaquin Valley. What is of interest is that even under socially optimal conditions, some degree of overdraft as indicated by increased pumping lifts, is warranted.

Another interesting result of the LQCM run was the differences in social cost (value) between DAUs. The social cost measures in dollars per acre-foot the loss of economic value to society if the groundwater pumping depths were to be lowered an additional foot in the particular year. Another way of looking at the social cost is that it measures the cost that all groundwater users in a particular DAU place on each other.

The magnitude of the social cost also provides a measure of the divergence between the social value of the groundwater and the private cost of using it. Thus, the smaller the social cost the closer the private cost and social value are.

The magnitude of the social cost is a function of both the economic and hydrologic parameters that characterize groundwater use in a specific DAU. (For example, see Noel, et.al. (1980)) or Gisser and Sanchez (1980). The magnitude of the social cost is also an indicator of whether social interaction into current groundwater allocation process should be made. If the transaction cost of a groundwater management plan is greater than the social cost currently being incurred, society is made worse off by social intervention into the allocation process.

The difference in social costs between different DAUs also indicates that, depending on the terms of trade, a potential for water transfer exists that would increase the total social value of the resource in the total basin.

Caution must be applied when looking at these results for three reasons. First, the hydrology underlying this analysis is hypothetical. Second, the LQCM does not account for moisture-deficient soils or for subsidence effects.

Third, the pumpage is for applied crop use and does not account for other types of groundwater pumpage (drainage, etc). However, the results do indicate that it is not possible to generalize from DAU to DAU concerning groundwater management and that in certain cases a degree of overdraft is socially optimal.

Tables 6.2.1 to 6.2.5 provide information on land use, total crop production and price, total water use, net farm income, water use by source by DAU, and crop acreage by DAU for the years 1981, 1985, 1990, 1995, and 2000. This land use, cropping patterns and net farm income information is determined by both economic and hydrologic factors. As discussed in Chapter 2, the San Joaquin Valley Production Model (SJVPM) receives information on surface water availability from the Surface Water Allocation Model (SWAM) and information on groundwater pumpage and pumping lifts, and hence pumping cost from the LQCM. This information plus information on crop demand and crop production costs is used by the SJVPM to determine the aforementioned results.

These results indicate the impact on the agricultural sector that different water use and/or management scenarios would have. For Scenario I under socially optimal groundwater usage, total land use increases slightly from 4,111,201 irrigated acres to a high of 4,193,041 acres in 1995 to 4,175,448 acres in 2000, which is an increase of 64,247 acres of irrigated land. Total water use varies from 14,014,032 acre-feet in 1981 to 14,163,392 in 1995 to 14,032,130 in 2000. This results in an approximate applied water figure of 3.4 acre-feet to the acre. Net farm income over the period 1981 to 2000 increases from $2,215,567,360 to $3,297,098,752, an increase of $1,081,531,392 in real 1980 dollars.

The distribution of groundwater and surface water by DAU, as shown in Table 6.2.I, follows the SWAM and LQCM results. There are, however, some discrepancies between the groundwater used by the SJVPM and that indicated in Tables 6.1.1 through 6.1.9. These discrepancies are due chiefly to the linearity assumption of the water demand estimation procedure. Where this assumption is weak the LQCM tended to overallocate groundwater. For example, on Table 5.1.1 the pumpage for DAU 211 is indicated to be 30,490 acre-feet and the production model used 23,434 acre-feet in 1981. This only happens in a

few DAU's and the majority of the LQCM predicted allocation and SJVPM groundwater usage are exactly the same.

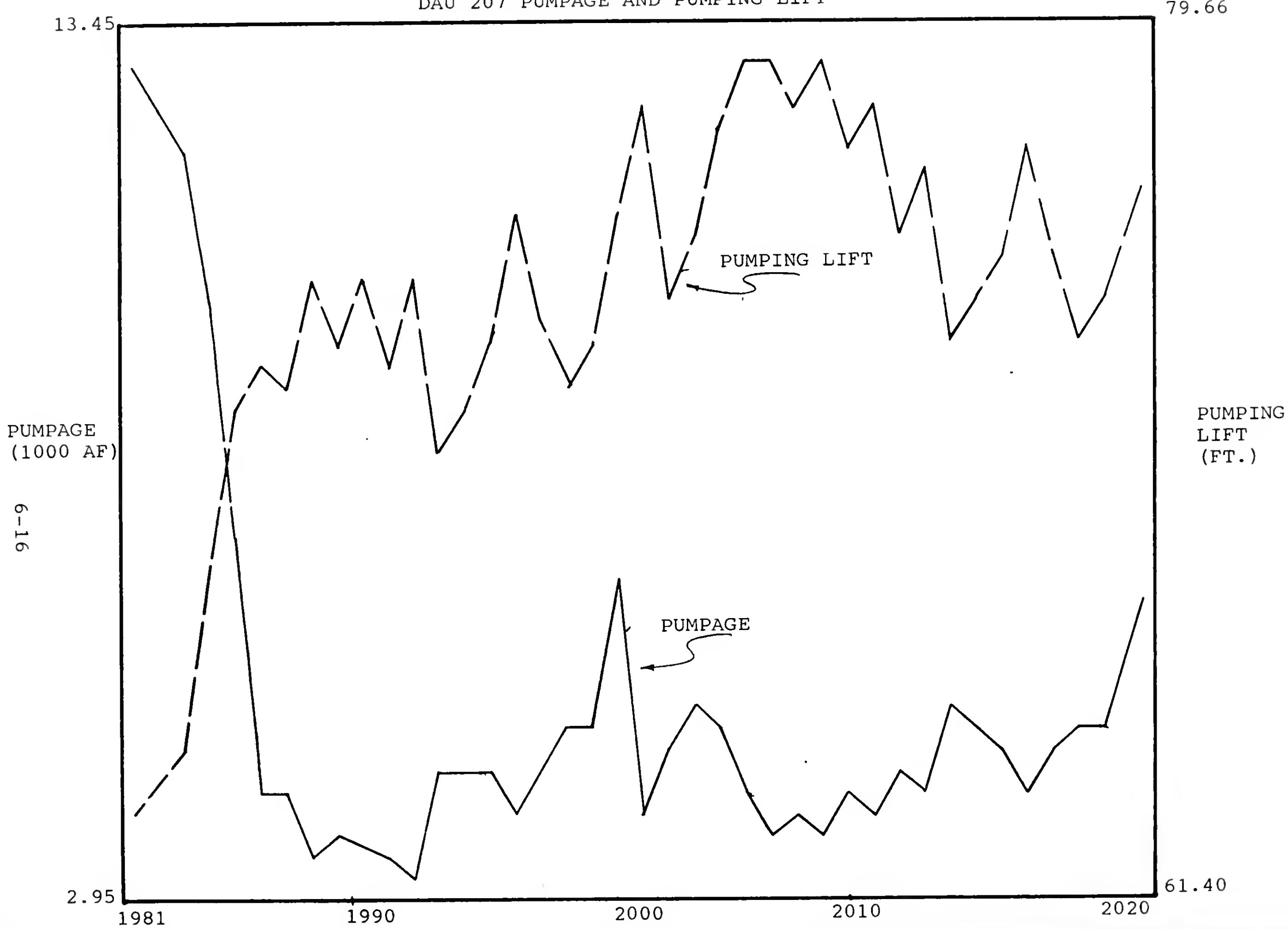
The remaining parts of Tables 6.2.1 through 6.2.5 indicate crop acreage by DAU. For the most part these results indicate that grain crops, some field crops, and irrigated pasture will decline in acreage under Scenario I conditions, that vegetable crops and fruit and nuts will expand slightly, and that cotton acreage will remain fairly stable.

6.4 RESULTS OF SCENARIO II

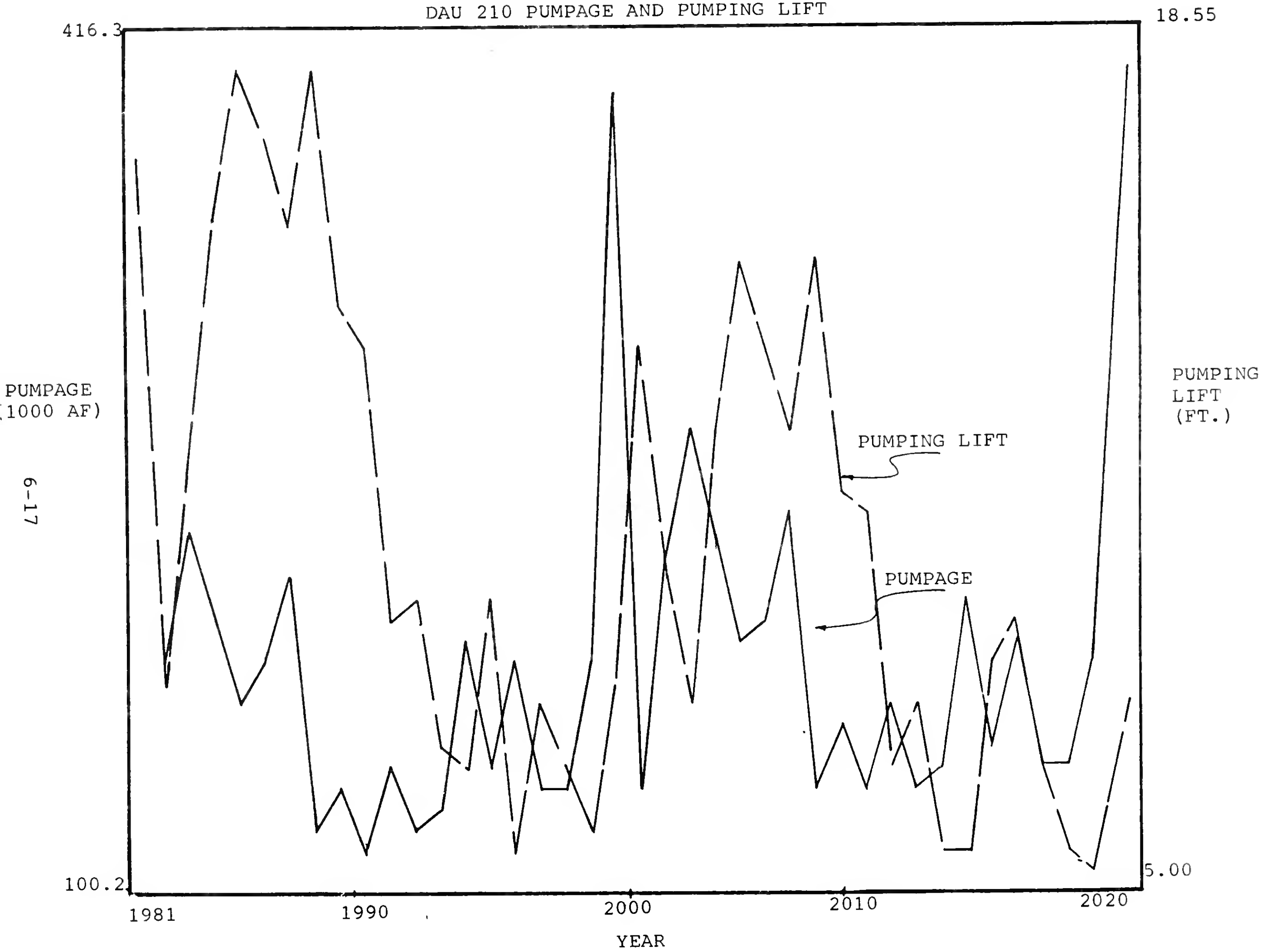
The results of the HEM run on Scenario II are contained in Tables 6.3.1 through 6.4.5. These results are similiar to those from Scenario I. Tables 6.3.1 through 6.3.9 show the LQCM results. The basic conclusion that can be drawn from these results is that less groundwater is used in the San Joaquin Valley than with Scenario I. This has an effect on pumping depths. In those DAU's where Scenario I showed declining average pumping lifts, the decline slowed down and in general the ending pumping lifts were less than Scenario I ending pumping lifts. For example, in DAU 261 the 2020 pumping lift in Scenario I was 769 while for Scenario II the lift was 688.5 feet. Thus, the additional surface water made the pumping lift for DAU 261 81 feet lower than without added surface water. It can be assumed that real 1980 energy cost in that period will be around $0.12 per kilowatt-hour, then this results in a cost savings of $15.31/AF for that area on the average. Graphs 6.2.1 through 6.2.7 illustrate the impact the additional surface water has on pumping lifts and pumpage for the same set of DAU's as Graphs 6.1.1 through 6.1.7 do in Section 6.3. Note that for every DAU that showed declining pumping lifts this decline is slower but that a decline still occurs, indicating that some degree of overdrafting is still socially optimal although the rate of overdraft has declined. Again it must be remembered that the pumpage represented here is only for applied water purposes. However, this result does indicate that under socially optimal conditions the rate of overdraft in the Valley would be slowed by the hydrologic assumptions presented in Section 6.2.2.

Tables 6.4.1 through 6.4.5 present the land, water and crop forecasts for Scenario II similiarly to Tables 6.2.1 through 6.2.5 for Scenario I. Tables

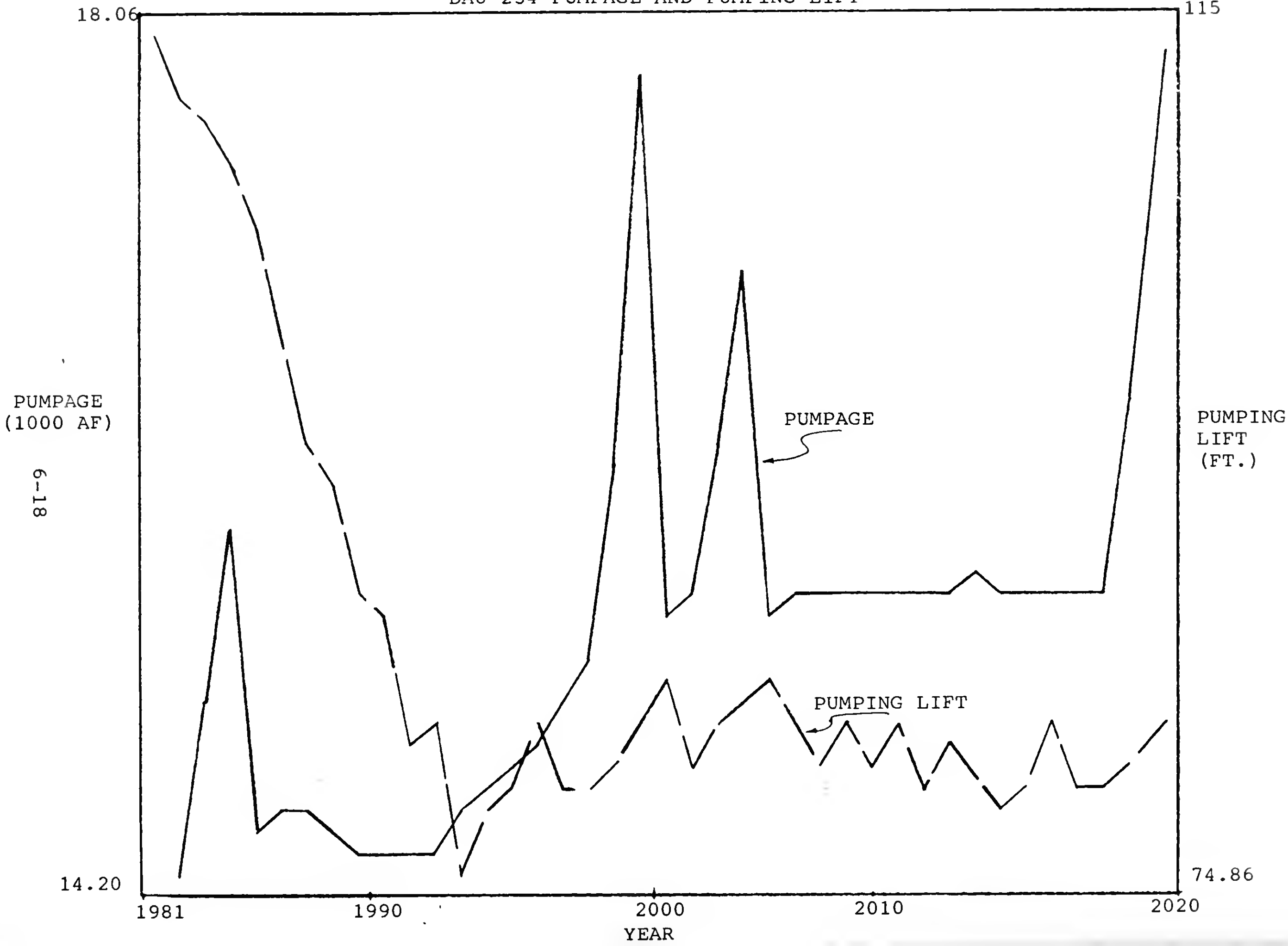
GRAPH 6.2.1
SCENARIO II
DAU 207 PUMPAGE AND PUMPING LIFT



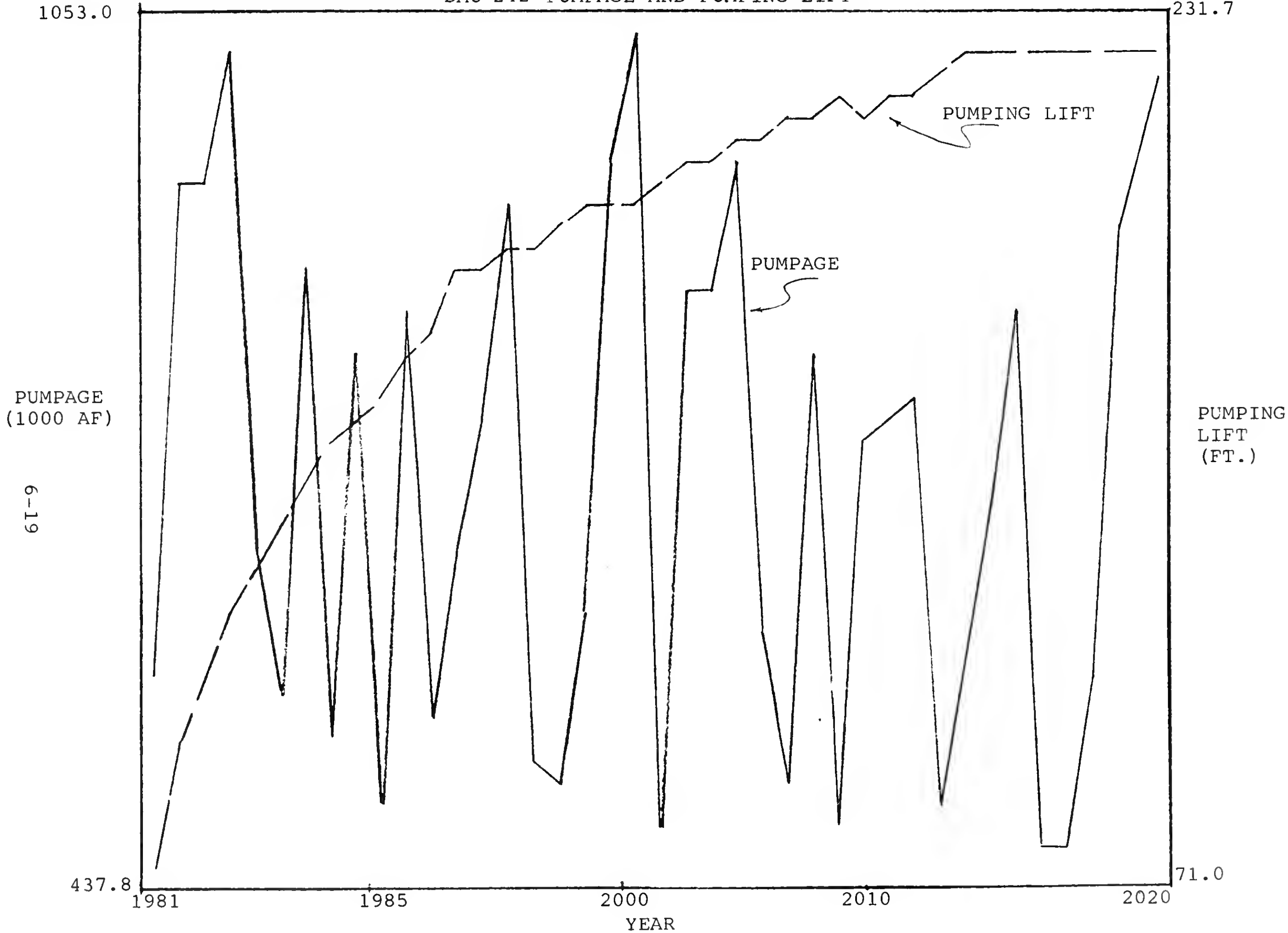
GRAPH 6.2.2
SCENARIO II
DAU 210 PUMPAGE AND PUMPING LIFT



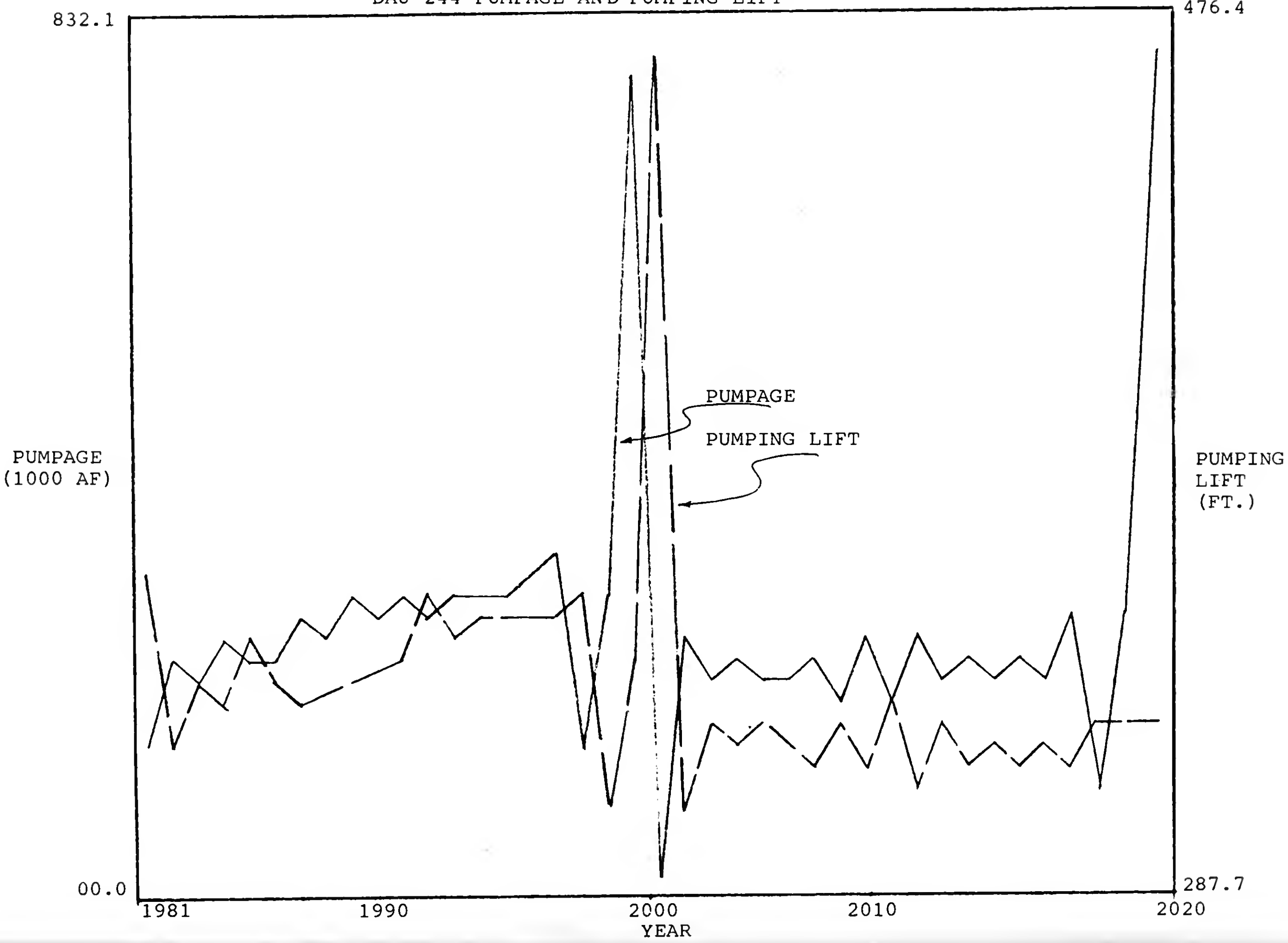
GRAPH 6.2.3
SCENARIO II
DAU 234 PUMPAGE AND PUMPING LIFT



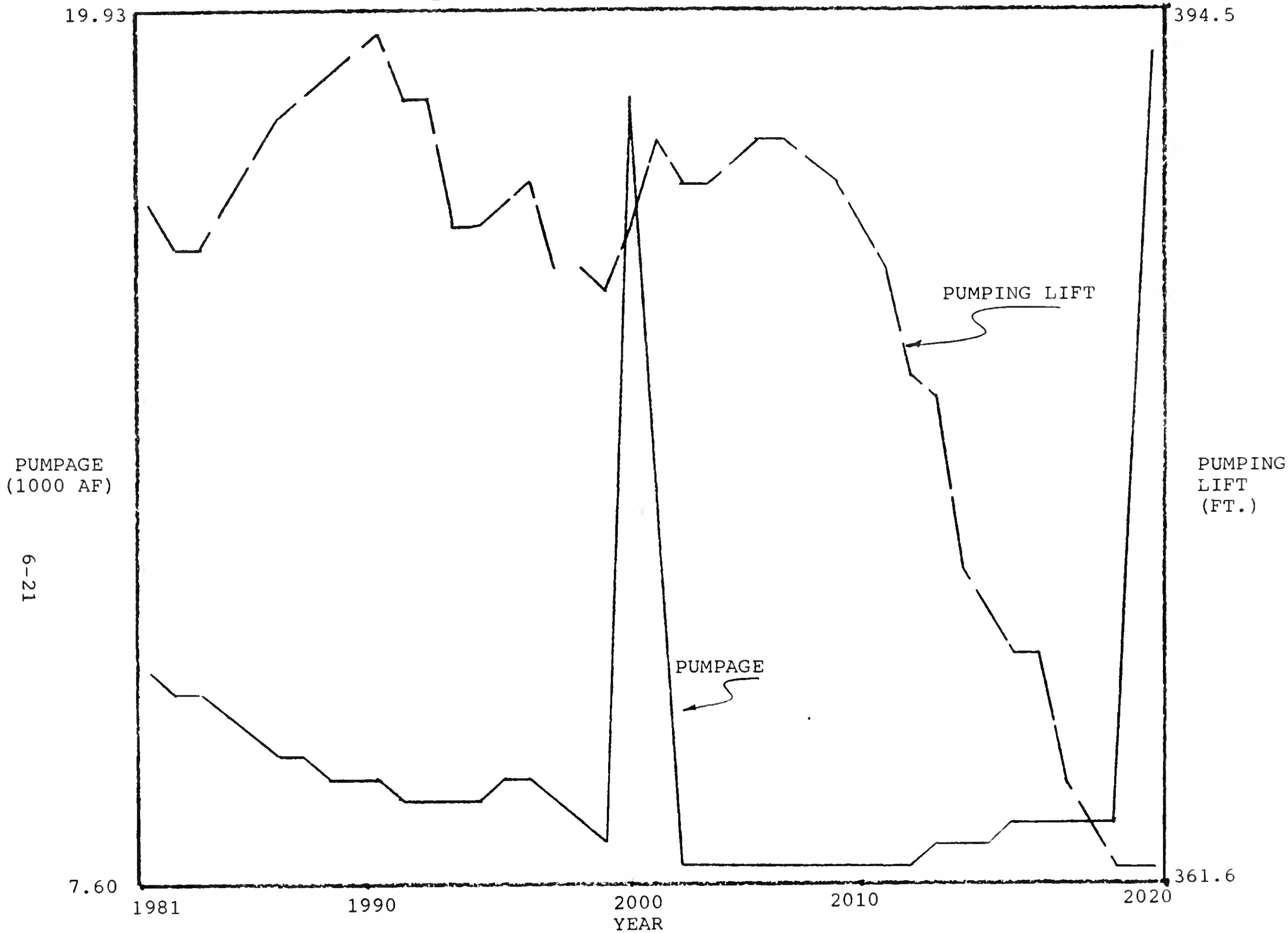
GRAPH 6.2.4
SCENARIO II
DAU 242 PUMPAGE AND PUMPING LIFT



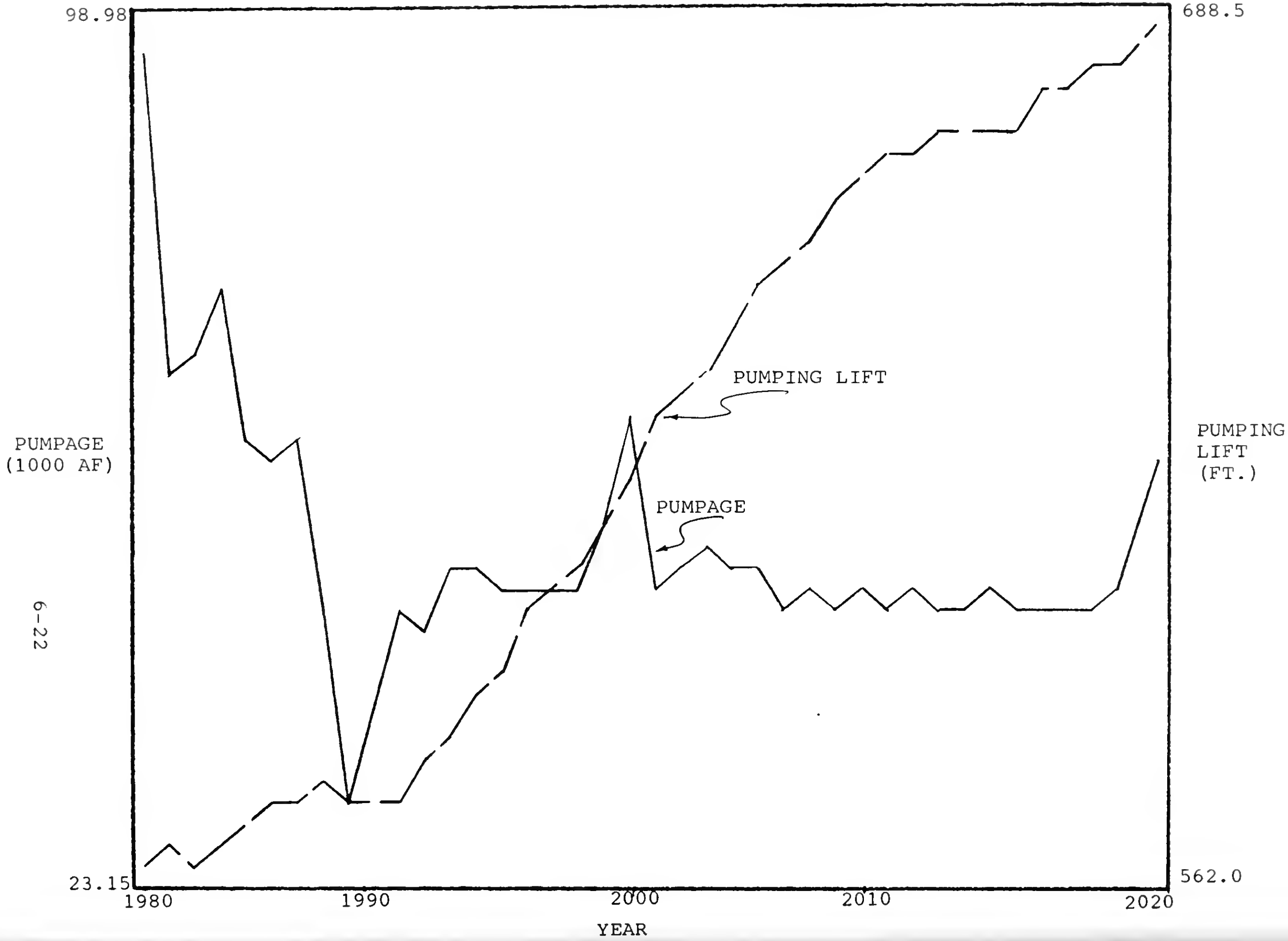
GRAPH 6.2.5
SCENARIO II
DAU 244 PUMPAGE AND PUMPING LIFT



GRAPH 6.2.6
SCENARIO II
DAU 257 PUMPAGE AND PUMPING LIFT



GRAPH 6.2.7
SCENARIO II
DAU 261 PUMPAGE AND PUMPING LIFT



6.4.1 through 6.4.5 show that land use under Scenario II conditions will expand. For Scenario II land use in 1981 is 4,110,945 and for 2000 land use is 4,203,698. This represents an additional 28,250 acres of irrigated land over the additional acreage forecast under Scenario I conditions. This increase is directly attributable to the increase in surface water availability, since the economic factors remain essentially the same between the two scenarios.

Correspondingly, water use also increases during the same period. This increase in the year 2000 is 132,319 acre-feet. This is a relatively small increase over the Scenario I water use figure; however, the distribution of ground and surface water changes. For example, in 1995 in Scenario I, 54 percent of the applied water is groundwater while in Scenario II 50 percent of the applied water is groundwater. This four percent difference amounted to approximately 450,000 acre-feet of groundwater which is left in storage in 1995 in Scenario II, mostly in the southern portion of the Valley.

Crop use between the two scenarios did not change much. Most of the change was in the small grain and field crop production. Scenario II had more small grain production, more irrigated pasture production, and more field crop production. Most of this increase is attributable to the additional surface water supply associated with Scenario II.

A final observation that can be made from these tables is the change in net farm income that results from the additional surface water availability. The year 2000 in Scenario I showed net farm income of $3,297,098,752.00 and the same year for Scenario II showed net farm income of $3,328,780,800.00. This represents a change of $31,682,048.00 in real 1980 dollars, or a 0.96 percent increase. The difference in applied surface water for that year between the two scenarios is 823,779 acre-feet. Thus, the additional surface water has an average value of $38.461 acre-foot under socially optimal groundwater usage. Whether or not this value is sufficient to support the additional surface water implied by Scenario II conditions requires more information than is provided here. However, it is an important indicator of whether additional surface water should be provided to Valley water users.

6.5 SUMMARY

The most important reason why the two scenarios described in Section 5.2 were run using the HEM system, was to show the proficiency of the system. That is, to show how HEM can be used to provide decision makers with information that will aid them in policy making. The two scenarios demonstrate that the HEM system is capable of providing policy makers with a tremendous amount of information. The HEM system can be broken up into its individual components and used for a variety of purposes. For example, SWAM can be used to look at different surface water allocation schemes, or it can have its network enlarged to allow more in-depth information at the water district level or smaller to be used in determining the impact of different surface water allocation schemes on groundwater pumpage and depths given a specified cropping pattern.

Additionally, although not done for these two scenario runs, the finite element groundwater model and flux estimators can be incorporated in the HEM framework to provide more detailed information on changes in pumping depths and state water levels in both the confirmed and unconfirmed aquifers, to determine overdraft conditions more fully than can the LQCM, and to observe the impact of subsidence where it occurs.

The results of the HEM provide for both scenarios; while open to criticism about data limitations and/or assumptions about future energy costs, surface water costs, and crop demands, appear to be internally consistent. That is, given the underlying assumptions, the results make sense.

Many misconceptions exist about the value of mathematical models such as the HEM system, particularly when used for planning purposes. At one extreme, there are people who deny that models have any value at all when put to such purposes. Their criticisms are often based on the impossibility of satisfactorily quantifying much of the required data, e.g., attaching a cost or utility to a social value. A less severe criticism surrounds the lack of precision of much of the data which may go into a mathematical model. For example if there is doubt surrounding 100000 of the coefficients in a model, how can we have any confidence in an answer it produces? The first of these

criticisms is a difficult one to counter. It seems undeniable, however, that many decisions concerning unquantifiable concepts, however they are made, involve an implicit quantification which cannot be avoided. Making such a quantification explicit by incorporating it in a mathematical model seems more honest as well as scientific. The second criticism concerning accuracy of the data should be considered in relation to each specific model. Although many coefficients in a model may be inaccurate, it is still possible that the structure of the model results in little inaccuracy in the solution.

At the opposite extreme to the people who utter the above criticisms are those who place an almost metaphysical faith in a mathematical model for decision making (particularly if it involves using a computer). The quality of the answers which a model produces obviously depends on the accuracy of the structure and data of the model.

A model should be used as one of the number of tools for decision making. The answer which a model produces should be subjected to close scruntiny. If it represents an unacceptable operating plan, then the reasons for unacceptability should be spelled out and if possible incorporated in a modified model. Should the answer be acceptable, it might be wise only to regard it as one of a set of possible answers.

The results that HEM gives for the two scenarios run in this study need to be viewed with the above in mind. Three general conclusions can be drawn from socially optimal results generated by the HEM system under Scenario I and Scenario II conditions. First, that some degree of overdraft is socially optimal in the San Joaquin Valley and this degree of overdraft varies widely between DAU's and is sensitive to availability of surface water. Thus, a blanket policy stating that all the groundwater sub-units making up the San Joaquin Valley groundwater basin should be managed to achieve a singe goal, i.e. no more overdraft, is sub-optimal. That is, it is against society's best interests.

Second, much of the Valley's water shortage problems, especially during periods of limited surface water availability should be made up by overdrafting the basin and even this could be prevented by allowing

groundwater and surface water transfers between DAUs. This is illustrated by looking at the water demand table (Table 4-5) and the groundwater social costs (Table series 6.1 through 6.3). The social costs also act as a measure of the economic benefit to be gained by enforcing some type of social management. If the costs of management exceed the social value of management, then society is worse off than if the status quo had remained in effect.

Finally, the value of the additional (SB200) surface water coming into the study area in the year 2000 given the socially optimal allocation of groundwater is appproximately 38.00/AF. This is the amount of net farm income gain accruing to the entire study area for each additional acre-foot of additional water. The decision of whether or not this water should be supplied should be evaluated in light of who benefits and who pays. It is possible that if the burden of paying for this water falls on a small group of producers in the study area that the "new" surface water price may exceed its marginal value. Additionally, other factors need to be considered which are not accounted for in this analysis: political, environmental, etc., which affect this decision.

TABLE 6.1.1

OUTPUT OF CONTROL MODEL
SCENARIO 1

1981

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)
206	8,157	14.00
207	13,450	63.00
208	52,150	10.00
209	99,670	93.00
210	100,200	17.00
211	30,490	130.00
212	214,500	39.00
213	345,600	86.00
214	189,900	104.00
215	380,500	70.00
216	0	128.00
233	97,510	67.00
234	14,190	115.00
235	449,300	67.00
236	180,700	42.00
237	249,800	63.00
238	329,500	73.00
239	102,000	23.00
240	84,860	38.00
241	424,500	60.00
242	645,500	71.00
243	431,300	114.00
244	142,600	360.00
245	81,400	312.00
246	42,720	114.00
254	263,300	169.00
255	399,400	134.00
256	294,600	181.00
257	10,590	388.00
258	27,010	528.00
259	0	220.00
261	100,300	562.00

TABLE 6.1.2

OUTPUT OF CONTROL MODEL
SCENARIO 1

1985

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	66,680	8.81	6,002.00
207	7,486	71.80	959.30
208	115,300	5.00	9,611.00
209	106,400	89.68	11,380.00
210	168,200	18.87	20,480.00
211	30,650	124.30	3,566.00
212	251,300	36.39	21,220.00
213	310,800	94.30	25,480.00
214	189,500	108.20	16,110.00
215	393,800	88.40	35,370.00
216	0	119.00	10,100.00
233	94,280	31.83	11,330.00
234	14,430	106.90	1,540.00
235	447,400	62.73	54,720.00
236	254,600	45.87	26,590.00
237	283,700	61.18	21,670.00
238	267,300	119.00	20,400.00
239	123,800	8.29	15,290.00
240	82,210	46.06	1,035.00
241	269,900	104.50	53.74
242	748,700	134.20	59,460.00
243	492,100	102.90	46,190.00
244	220,500	346.80	11,420.00
245	68,690	339.40	5,710.00
246	10,120	142.00	3,485.00
254	187,500	193.10	16,420.00
255	402,900	133.80	24,610.00
256	348,000	193.40	33,670.00
257	9,560	390.00	3,088.00
258	0	507.70	465.50
259	0	220.60	2,281.00
261	50,980	575.10	2,684.00

TABLE 6.1.3

OUTPUT OF CONTROL MODEL
SCENARIO 1

1990

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	19,880	5.78	4,230.00
207	2,951	74.86	821.80
208	57,880	5.00	8,236.00
209	106,800	86.62	15,560.00
210	115,100	14.31	20,350.00
211	30,970	121.30	4,964.00
212	208,400	34.93	26,300.00
213	284,500	100.20	38,660.00
214	193,000	109.20	24,710.00
215	381,600	105.20	50,230.00
216	0	119.00	13,580.00
233	119,100	5.07	21,020.00
234	14,310	87.79	2,187.00
235	436,000	62.47	82,590.00
236	199,100	42.54	35,530.00
237	215,000	58.28	27,180.00
238	261,200	112.00	32,350.00
239	112,800	5.00	24,450.00
240	96,150	43.97	2,080.00
241	224,500	98.78	9,990.00
242	556,800	170.10	90,560.00
243	411,100	96.42	74,170.00
244	246,900	355.80	19,960.00
245	71,440	378.70	8,888.00
246	17,600	140.10	8,980.00
254	166,200	214.90	34,500.00
255	303,100	138.80	33,530.00
256	267,200	194.70	45,550.00
257	9,027	394.10	8,585.00
258	0	492.90	1,278.00
259	0	220.70	1,807.00
261	35,090	586.50	3,421.00

TABLE 6.1.4

OUTPUT OF CONTROL MODEL
SCENARIO 1

1995

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	30,900	5.00	6,691.00
207	4,322	73.32	1,298.00
208	64,760	5.00	13,440.00
209	111,000	83.54	23,120.00
210	141,900	5.12	35,320.00
211	30,160	113.10	7,608.00
212	229,100	26.62	41,280.00
213	481,000	95.92	67,550.00
214	203,400	104.90	35,060.00
215	392,100	109.20	70,820.00
216	28,000	119.00	13,950.00
233	222,000	5.00	38,430.00
234	14,720	80.25	3,258.00
235	439,100	58.12	111,700.00
236	375,900	33.61	59,140.00
237	369,700	54.68	47,250.00
238	347,300	104.70	51,050.00
239	225,600	5.00	38,350.00
240	99,490	44.33	5,403.00
241	429,000	94.71	11,210.00
242	993,000	195.00	139,700.00
243	620,000	93.70	108,600.00
244	280,700	354.10	31,190.00
245	72,110	420.40	12,350.00
246	33,560	141.90	11,060.00
254	387,600	234.30	68,850.00
255	472,000	141.40	55,960.00
256	428,900	187.50	72,210.00
257	8,881	387.60	7,117.00
258	51,370	498.60	8,681.00
259	0	217.90	3,813.00
261	82,090	609.30	9,098.00

TABLE 6.1.5

OUTPUT OF CONTROL MODEL
SCENARIO 1

2000

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	277,200	7.12	43,260.00
207	6,726	76.01	1,915.00
208	335,900	5.00	51,430.00
209	156,600	85.18	38,070.00
210	300,800	8.66	84,350.00
211	46,320	110.00	11,240.00
212	308,700	23.85	64,250.00
213	566,500	109.40	111,100.00
214	209,700	110.10	52,650.00
215	408,900	115.50	105,100.00
216	277,700	123.60	17,970.00
233	346,100	5.00	74,440.00
234	17,860	83.13	5,158.00
235	455,000	59.11	135,000.00
236	429,000	33.80	88,390.00
237	425,100	55.23	83,430.00
238	388,300	110.70	63,470.00
239	288,600	6.26	62,750.00
240	105,000	44.86	9,134.00
241	571,700	107.10	39,010.00
242	1,123,000	194.90	259,000.00
243	755,000	104.90	173,900.00
244	779,900	348.40	90,140.00
245	69,630	470.90	16,170.00
246	62,440	155.40	16,900.00
254	569,200	261.50	114,200.00
255	581,200	145.60	89,780.00
256	580,600	185.30	118,300.00
257	19,050	388.00	5,637.00
258	154,900	523.90	25,000.00
259	0	212.90	4,335.00
261	181,700	656.40	24,410.00

TABLE 6.1.6

OUTPUT OF CONTROL MODEL
SCENARIO 1

2005

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	78,560	9.77	23,610.00
207	4,088	79.66	2,552.00
208	110,500	5.00	31,680.00
209	111,200	86.97	40,700.00
210	190,900	15.38	72,610.00
211	36,280	117.30	14,170.00
212	254,100	27.32	77,720.00
213	338,900	118.30	98,430.00
214	210,000	115.10	64,350.00
215	395,900	114.60	128,700.00
216	36,470	120.60	21,310.00
233	121,200	5.00	46,450.00
234	15,450	85.58	5,971.00
235	438,900	62.05	189,800.00
236	265,200	40.36	92,620.00
237	266,600	57.84	70,620.00
238	250,100	115.10	70,100.00
239	138,800	7.74	56,830.00
240	96,060	45.40	7,167.00
241	347,700	118.00	4,873.00
242	956,600	190.90	294,400.00
243	467,300	120.50	172,700.00
244	190,500	337.30	38,730.00
245	55,170	525.50	16,850.00
246	28,330	168.30	19,630.00
254	269,500	293.30	93,390.00
255	434,500	148.50	96,550.00
256	286,200	192.00	103,800.00
257	7,559	393.70	15,280.00
258	24,840	567.10	7,429.00
259	0	206.60	9,681.00
261	78,540	695.00	15,700.00

TABLE 6.1.7

OUTPUT OF CONTROL MODEL
SCENARIO 1

2010

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	26,700	6.74	15,480.00
207	3,897	78.44	3,032.00
208	56,370	5.00	24,600.00
209	111,400	84.57	48,990.00
210	138,600	11.40	69,460.00
211	36,200	119.40	17,070.00
212	214,800	28.29	83,700.00
213	310,000	115.00	127,000.00
214	210,000	115.00	82,540.00
215	388,600	117.30	158,400.00
216	37,620	120.00	27,330.00
233	130,200	5.00	65,140.00
234	15,490	82.98	7,279.00
235	439,700	62.28	249,000.00
236	188,700	38.86	103,800.00
237	212,200	55.75	83,800.00
238	250,200	111.50	95,520.00
239	122,100	5.00	75,680.00
240	96,070	44.18	6,818.00
241	285,500	117.40	19,260.00
242	949,200	196.60	361,400.00
243	388,400	115.00	227,200.00
244	172,400	337.60	47,190.00
245	49,700	584.60	19,000.00
246	33,750	175.10	33,560.00
254	122,700	309.80	99,010.00
255	354,200	145.80	109,700.00
256	266,500	181.20	137,300.00
257	7,608	390.90	22,130.00
258	29,680	594.80	19,420.00
259	0	195.90	14,410.00
261	102,300	725.30	27,410.00

TABLE 6.1.8

OUTPUT OF CONTROL MODEL
SCENARIO 1

2015

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	45,260	5.04	24,260.00
207	4,718	75.04	3,884.00
208	66,010	5.00	35,700.00
209	111,800	82.10	60,260.00
210	153,500	8.90	94,320.00
211	36,460	113.50	20,990.00
212	226,900	21.90	107,400.00
213	477,100	105.00	173,500.00
214	210,400	109.40	93,630.00
215	399,600	115.70	188,700.00
216	39,940	119.40	29,590.00
233	229,000	5.00	101,600.00
234	15,520	80.52	8,858.00
235	443,900	57.46	281,300.00
236	361,500	30.76	145,100.00
237	372,100	51.70	130,000.00
238	345,000	101.50	128,200.00
239	229,500	5.00	99,760.00
240	96,050	44.07	15,020.00
241	486,100	105.30	37,680.00
242	1,015,000	202.70	448,300.00
243	592,100	106.80	288,800.00
244	208,200	326.70	61,400.00
245	44,270	641.90	19,900.00
246	43,780	171.50	34,260.00
254	338,300	318.30	164,100.00
255	505,300	143.50	160,300.00
256	423,500	167.30	189,300.00
257	8,053	377.20	21,880.00
258	58,860	621.70	26,090.00
259	0	188.30	14,830.00
261	126,400	740.40	37,120.00

TABLE 6.1.9

OUTPUT OF CONTROL MODEL
SCENARIO 1

2020

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	281,400	7.24	0.00
207	6,702	76.80	0.00
208	337,900	5.00	0.00
209	157,800	84.00	0.00
210	416,200	7.95	0.00
211	36,750	111.20	0.00
212	316,500	20.27	0.00
213	574,100	113.60	0.00
214	211,200	112.20	0.00
215	432,700	119.70	0.00
216	287,900	123.70	0.00
233	350,700	5.00	0.00
234	18,050	83.33	0.00
235	471,200	58.47	0.00
236	427,500	31.69	0.00
237	437,900	53.53	0.00
238	411,700	106.50	0.00
239	291,200	6.30	0.00
240	104,600	44.80	0.00
241	621,300	111.90	0.00
242	1,133,000	200.00	0.00
243	790,800	111.20	0.00
244	813,400	334.50	0.00
245	40,240	704.70	0.00
246	63,090	178.80	0.00
254	526,200	334.70	0.00
255	601,500	146.60	0.00
256	588,100	160.30	0.00
257	19,640	371.00	0.00
258	141,700	652.70	0.00
259	0	182.80	0.00
261	177,400	769.30	0.00

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 1
1981

TABLE 6.2.1

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,073,321.0
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,037,880.8
TOTAL GROUND WATER USED (AC-FT)	5,843,916.0
TOTAL SURFACE WATER USED (AC-FT)	8,170,116.0
CONSUMER SURPLUS	$ 695,974,016.0
NET FARM INCOME	$2,215,567,360.0

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	98,783.3	5.49	CWTS
BARLEY	387,124.0	5.30	CWTS
OATS	10,500.0	5.02	CWTS
RICE	32,059.5	8.27	CWTS
SORGHUM	15,140.2	4.53	CWTS
SUGAR BEETS	62,357.2	49.73	TONS
SAFFLOWER	31,807.0	227.24	TONS
IRRIGATED PASTURE	35,224.7	117.76	ACRES
COTTON	1,471,280.0	370.80	BALES
CORN	141,910.2	5.38	CWTS
DRY BEANS	73,761.0	24.94	CWTS
ALFALFA	377,498.8	70.28	TONS
SNAPBEANS	2,642.0	600.66	TONS
CARROTS	11,452.0	10.71	CWTS
FALL CAULIFLOWER	1,371.0	26.09	CWTS
OTHER CAULIFLOWER	2,151.0	28.66	CWTS
GARLIC	4,798.0	322.54	TONS
LIMA BEANS	11,965.0	371.91	TONS
LETTUCE	16,979.0	211.62	TONS
CANTALOUPS	36,430.0	235.77	TONS
ONIONS	15,579.0	131.08	TONS
FRESH PEAS	1,679.0	573.54	TONS
PROCESSING PEAS	2,906.0	194.96	TONS
BELL PEPPERS	2,381.0	23.70	CWTS
WINTER POTATOES	1,377.0	8.29	CWTS
SPRING POTATOES	25,253.0	7.51	CWTS
SWEET POTATOES	8,260.0	325.60	TONS
SPINACH	1,831.0	68.50	TONS
FRESH TOMATOES	10,558.0	467.72	TONS
PROCESSING TOMATOES	78,586.0	60.52	TONS
ALMONDS	267,184.0	1,546.11	TONS
FRESH APPLES	1,185.0	289.61	TONS
PROCESSING APPLES	1,591.0	209.63	TONS
APRICOTS	11,903.0	232.99	TONS
AVOCADOS	959.0	799.89	TONS
FIGS	12,516.0	329.60	TONS
GRAPEFRUIT	909.0	249.21	TONS
TABLE GRAPES	64,058.0	307.53	TONS
RAISIN GRAPES	252,605.0	264.50	TONS
WINE GRAPES	191,606.0	264.90	TONS
FRESH LEMONS	2,309.0	257.90	TONS
PROCESSING LEMONS	4,581.9	40.15	TONS
NECTARINES	14,177.0	358.02	TONS
OLIVES	25,328.0	409.80	TONS
FRESH ORANGES	88,565.0	244.69	TONS
PROCESSING ORANGES	38,743.0	47.63	TONS
PEACHES	46,387.0	183.91	TONS
PISTACHIOS	25,585.0	1,559.78	TONS
PLUMS	24,997.0	468.89	TONS
PRUNES	5,541.0	615.10	TONS
WALNUTS	70,104.0	1,470.29	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)

1981

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	8,157.0	475,832.0
207	13,450.0	7,603.0
208	52,150.0	451,118.0
209	85,722.0	83,303.0
210	100,200.0	406,189.0
211	23,434.0	0.0
212	214,500.0	122,439.0
213	345,600.0	206,692.0
214	189,900.0	4,800.0
215	380,501.0	69,602.0
216	0.0	938,203.0
233	97,510.0	373,344.0
234	9,567.5	9,808.0
235	449,300.0	34,217.0
236	180,700.0	316,327.0
237	249,800.0	280,939.0
238	329,500.0	177,656.0
239	102,000.0	184,568.0
240	84,860.0	24,405.7
241	424,500.0	325,361.0
242	645,500.0	667,345.0
243	431,300.0	398,992.0
244	142,600.0	1,025,073.0
245	81,400.0	13,716.0
246	42,720.0	40,397.1
254	263,300.0	416,980.0
255	399,400.0	266,891.0
256	294,600.0	302,296.0
257	4,833.9	62,492.0
258	27,010.0	177,293.0
259	0.0	277,309.0
260	0.0	4,000.0
261	100,300.0	94,528.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,685.0	0.0	0.0	12,381.0	1,260.0	0.0
207	1,766.0	15,513.0	0.0	0.0	0.0	0.0
208	3,756.0	0.0	0.0	0.0	0.0	357.0
209	3,451.0	30,630.0	0.0	0.0	1,230.0	0.0
210	3,204.0	13,629.0	0.0	5,181.5	0.0	0.0
211	2,470.0	8,415.0	0.0	0.0	0.0	0.0
212	5,409.0	0.0	0.0	2,740.0	1,630.0	9,095.0
213	0.0	7,834.0	4,000.0	0.0	0.0	544.0
214	10,955.0	19,955.0	0.0	0.0	0.0	0.0
215	7,354.9	8,119.0	6,500.0	742.0	0.0	7,131.0
216	7,613.0	0.0	0.0	4,202.0	1,840.0	16,286.0
233	0.0	4,028.0	0.0	253.0	0.0	0.0
234	1,485.0	1,782.0	0.0	0.0	0.0	0.0
235	0.0	9,553.0	0.0	0.0	0.0	1,692.0
236	858.3	0.0	0.0	0.0	0.0	0.0
237	2,463.0	28,027.0	0.0	0.0	1,062.7	2,548.0
238	2,786.0	17,153.0	0.0	545.0	6,534.0	497.0
239	2,647.0	9,900.0	0.0	0.0	365.6	860.0
240	1,098.0	495.0	0.0	0.0	0.0	0.0
241	4,897.6	57,464.0	0.0	290.0	693.0	6,291.0
242	7,338.0	44,820.0	0.0	905.0	0.0	1,757.0
243	14,355.0	39,600.0	0.0	3,170.0	0.0	1,081.0
244	0.0	0.0	0.0	0.0	0.0	6,650.0
245	0.0	12,028.0	0.0	0.0	0.0	0.0
246	2,829.0	16,559.0	0.0	0.0	525.0	0.0
254	549.0	0.0	0.0	1,650.0	0.0	1,449.0
255	0.0	16,870.0	0.0	0.0	0.0	2,898.0
256	6,299.5	0.0	0.0	0.0	0.0	580.0
257	2,514.0	24,750.0	0.0	0.0	0.0	0.0
258	0.0	0.0	0.0	0.0	0.0	920.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	746.2
261	0.0	0.0	0.0	0.0	0.0	975.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	12,920.9	0.0	21,262.0	0.0	3,040.0
207	0.0	1,718.7	0.0	298.0	0.0	0.0
208	0.0	4,321.2	0.0	35,880.0	4,300.0	16,860.0
209	0.0	0.0	0.0	2,668.0	3,340.0	790.0
210	0.0	0.0	33,390.0	8,828.0	1,640.0	6,740.0
211	0.0	0.0	0.0	570.0	0.0	180.0
212	500.0	15,495.1	0.0	13,220.0	1,810.0	14,390.0
213	0.0	0.0	55,473.0	0.0	1,520.0	17,295.0
214	0.0	0.0	5,161.0	1,958.7	1,025.0	500.0
215	0.0	0.0	35,989.0	4,110.0	2,265.0	27,205.0
216	500.0	0.0	69,540.0	24,626.0	29,310.0	35,500.0
233	0.0	410.6	29,349.0	4,222.0	886.0	9,184.0
234	0.0	0.0	0.0	670.0	0.0	0.0
235	0.0	0.0	46,935.0	5,628.1	2,039.0	30,447.0
236	0.0	0.0	4,102.0	0.0	546.0	2,372.0
237	1,327.0	0.0	64,066.0	5,086.1	995.0	31,920.0
238	3,700.0	358.1	76,461.0	7,170.0	0.0	19,389.0
239	0.0	0.0	15,159.0	3,035.0	668.0	6,901.0
240	0.0	0.0	716.0	0.0	0.0	157.0
241	22,500.0	0.0	136,531.0	2,098.4	0.0	1,975.0
242	0.0	0.0	121,915.0	0.0	4,540.0	41,773.0
243	0.0	0.0	107,987.0	0.0	12,745.0	25,839.0
244	0.0	0.0	258,248.4	0.0	4,317.0	0.0
245	0.0	0.0	15,115.0	0.0	0.0	2,524.9
246	0.0	0.0	4,420.0	580.0	1,815.0	495.0
254	3,280.0	0.0	126,178.0	0.0	0.0	33,413.0
255	0.0	0.0	99,414.0	0.0	0.0	32,076.0
256	0.0	0.0	67,945.0	0.0	0.0	16,533.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	23,772.3	0.0	0.0	0.0
259	0.0	0.0	34,291.9	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	39,121.9	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1981

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	918.0	0.0	306.0	377.0	306.0	11,965.0
233	507.0	0.0	203.0	253.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	304.0	0.0	152.0	152.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	507.0	1,065.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	913.0	0.0	203.0	304.0	1,115.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	999.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	3,579.0	0.0	0.0	2,231.0	0.0
259	0.0	3,295.0	0.0	0.0	639.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	3,579.0	0.0	0.0	507.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,632.0	0.0	0.0	0.0	510.0
211	0.0	0.0	0.0	0.0	0.0	255.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	2,755.0	6,630.0	2,448.0	1,020.0	2,754.0	0.0
233	608.0	1,678.0	811.0	0.0	0.0	253.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,150.0	0.0	0.0	0.0	253.0
236	405.0	0.0	1,014.0	0.0	0.0	198.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,566.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	1,881.0	0.0	0.0	0.0	456.0
244	2,991.0	8,897.0	507.0	507.0	0.0	253.0
245	507.0	2,535.0	507.0	0.0	0.0	203.0
246	319.0	0.0	0.0	152.0	152.0	0.0
254	492.0	0.0	811.0	0.0	0.0	0.0
255	0.0	0.0	3,042.0	0.0	0.0	0.0
256	0.0	0.0	2,484.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	507.0	2,535.0	0.0	0.0	0.0	0.0
259	3,802.0	2,251.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	4,593.0	4,675.0	3,955.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,193.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	6,763.0	0.0	685.0	5,282.0
211	0.0	0.0	0.0	0.0	469.0	0.0
212	0.0	0.0	0.0	0.0	3,641.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	2,322.0
215	0.0	0.0	0.0	0.0	0.0	6,206.0
216	0.0	0.0	0.0	1,020.0	2,407.0	18,725.0
233	0.0	0.0	0.0	0.0	215.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	550.0	0.0
236	0.0	0.0	304.0	811.0	140.0	2,314.0
237	0.0	0.0	0.0	0.0	449.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	152.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	101.0	1,303.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	0.0	1,850.0	30,597.0
245	0.0	0.0	0.0	0.0	0.0	1,071.0
246	0.0	0.0	0.0	0.0	0.0	1,149.0
254	101.0	1,856.0	0.0	0.0	0.0	1,456.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	162.0	3,072.0	0.0	0.0	0.0	2,392.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	760.0	18,353.0	0.0	0.0	0.0	3,224.0
259	0.0	0.0	0.0	0.0	0.0	1,456.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	253.0	669.0	0.0	0.0	0.0	2,392.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	19,325.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,888.0	0.0	0.0	0.0	0.0	0.0	0.0
208	39,732.0	0.0	0.0	0.0	0.0	0.0	0.0
209	20,830.0	589.0	1,177.0	0.0	0.0	0.0	0.0
210	29,858.0	0.0	0.0	0.0	0.0	944.0	0.0
211	2,059.0	0.0	0.0	0.0	0.0	0.0	0.0
212	5,729.0	0.0	0.0	0.0	0.0	0.0	0.0
213	19,424.0	0.0	0.0	0.0	0.0	883.0	0.0
214	7,709.0	0.0	0.0	0.0	0.0	3,481.0	0.0
215	2,039.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,336.0	0.0	0.0	9,236.0	0.0	0.0	0.0
233	8,985.0	0.0	0.0	0.0	0.0	4,492.0	0.0
234	1,053.0	0.0	0.0	0.0	0.0	747.0	0.0
235	4,113.0	0.0	0.0	0.0	0.0	0.0	0.0
236	3,937.0	0.0	0.0	0.0	0.0	0.0	0.0
237	1,917.0	0.0	0.0	0.0	0.0	0.0	0.0
238	175.0	0.0	0.0	0.0	0.0	0.0	0.0
239	943.0	0.0	0.0	0.0	0.0	0.0	0.0
240	440.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	959.0	0.0	0.0
243	7,165.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,437.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,510.0	0.0	0.0	2,667.0	0.0	0.0	0.0
254	1,800.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,410.0	0.0	0.0	0.0	0.0	0.0	0.0
256	29,700.0	596.0	414.0	0.0	0.0	1,313.0	0.0
257	11,090.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,100.0	0.0	0.0	0.0	0.0	656.0	0.0
259	16,300.0	0.0	0.0	0.0	0.0	0.0	0.0
260	500.0	0.0	0.0	0.0	0.0	0.0	0.0
261	680.0	0.0	0.0	0.0	0.0	0.0	909.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,506.0	0.0	10,300.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,374.0	0.0	11,593.0	0.0	0.0	0.0	0.0
209	2,239.0	0.0	8,957.0	0.0	0.0	0.0	0.0
210	8,951.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	3,780.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	34,664.0	10,300.0	0.0	0.0	0.0	550.0
214	0.0	4,351.0	20,600.0	0.0	0.0	0.0	1,200.0
215	0.0	4,752.0	14,780.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	43,635.0	0.0	172.0	176.0	2,718.0	2,626.0
234	0.0	958.0	0.0	0.0	0.0	0.0	0.0
235	0.0	16,996.0	0.0	0.0	0.0	0.0	0.0
236	0.0	101,187.0	0.0	0.0	0.0	5,791.0	0.0
237	0.0	6,088.0	0.0	0.0	0.0	0.0	0.0
238	204.0	1,224.0	772.0	0.0	0.0	283.0	0.0
239	4,435.0	5,828.0	11,113.0	0.0	0.0	3,164.0	1,515.0
240	4,435.0	1,020.0	5,697.0	202.0	306.0	386.0	4,848.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	3,230.0	15,063.0	52,851.0	404.0	718.0	1,330.0	7,943.0
243	15,394.0	0.0	0.0	404.0	751.0	0.0	1,601.0
244	5,915.0	0.0	0.0	0.0	0.0	0.0	601.0
245	0.0	0.0	901.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	808.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	199.0	16,839.0	766.0	0.0	0.0	0.0	0.0
256	5,211.0	0.0	21,936.0	202.0	618.0	505.0	909.0
257	476.0	0.0	0.0	404.0	913.0	0.0	0.0
258	4,221.0	0.0	0.0	202.0	213.5	0.0	0.0
259	1,015.0	0.0	21,040.0	0.0	0.0	0.0	2,727.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	473.0	0.0	0.0	319.0	886.5	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	5,999.0	0.0	0.0	0.0	12,809.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	7,338.0	0.0	0.0	0.0	5,582.0
209	0.0	0.0	2,233.0	0.0	0.0	0.0	629.0
210	0.0	0.0	8,343.0	0.0	0.0	0.0	507.0
211	0.0	0.0	0.0	2,234.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,234.0	0.0	0.0	0.0
213	0.0	0.0	2,142.0	0.0	868.0	0.0	898.0
214	2,850.0	100.0	447.0	5,244.0	0.0	0.0	624.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,391.0	0.0	0.0	0.0	7,003.0
233	2,402.0	860.0	1,712.0	730.0	2,020.0	1,010.0	2,718.0
234	1,369.0	634.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,662.0	0.0	0.0	0.0	0.0
236	356.0	212.0	4,276.0	730.0	2,727.0	0.0	6,125.0
237	0.0	0.0	0.0	0.0	0.0	0.0	788.0
238	0.0	0.0	606.0	0.0	1,010.0	0.0	4,323.0
239	3,873.0	1,526.0	4,844.0	0.0	8,090.0	0.0	0.0
240	10,679.0	4,478.0	733.0	0.0	811.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	35,538.0	15,079.0	1,010.0	0.0	4,848.0	3,113.0	20,170.0
243	13,233.0	5,659.0	0.0	2,587.0	2,684.0	1,418.0	7,292.0
244	0.0	0.0	0.0	1,048.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	379.0	263.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	6,565.0	3,838.0	924.0	3,032.0	1,010.0	0.0	434.0
257	6,244.0	3,397.0	0.0	0.0	0.0	0.0	0.0
258	3,111.0	1,838.0	909.0	3,825.0	929.0	0.0	202.0
259	990.0	441.0	0.0	3,921.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	976.0	418.0	818.0	0.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 1
1985

TABLE 6.2.2

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,145,542.0
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	998,204.3
TOTAL GROUND WATER USED (AC-FT)	6,015,418.0
TOTAL SURFACE WATER USED (AC-FT)	8,197,778.0
CONSUMER SURPLUS	$ 751,555,968.0
NET FARM INCOME	$2,304,092,672.0

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	87,240.2	5.51	CWTS
BARLEY	370,375.2	5.28	CWTS
OATS	10,290.0	5.02	CWTS
RICE	39,506.0	9.01	CWTS
SORGHUM	20,701.8	4.53	CWTS
SUGAR BEETS	56,435.2	44.87	TONS
SAFFLOWER	31,783.0	229.79	TONS
IRRIGATED PASTURE	33,962.3	122.22	ACRES
COTTON	1,524,093.5	319.22	BALES
CORN	130,447.5	5.43	CWTS
DRY BEANS	72,678.0	27.09	CWTS
ALFALFA	373,981.5	74.28	TONS
SNAPBEANS	2,749.0	618.64	TONS
CARROTS	11,855.0	11.94	CWTS
FALL CAULIFLOWER	1,423.0	29.42	CWTS
OTHER CAULIFLOWER	2,232.0	31.98	CWTS
GARLIC	4,970.0	333.90	TONS
LIMA BEANS	13,508.0	390.12	TONS
LETTUCE	17,618.0	229.98	TONS
CANTALOUPS	37,828.0	266.11	TONS
ONIONS	16,161.0	145.15	TONS
FRESH PEAS	1,753.0	592.57	TONS
PROCESSING PEAS	4,308.0	203.33	TONS
BELL PEPPERS	2,476.0	24.68	CWTS
WINTER POTATOES	1,427.0	8.44	CWTS
SPRING POTATOES	26,139.0	7.62	CWTS
SWEET POTATOES	8,669.0	338.78	TONS
SPINACH	2,856.0	69.71	TONS
FRESH TOMATOES	11,036.0	523.46	TONS
PROCESSING TOMATOES	85,792.0	60.84	TONS
ALMONDS	271,315.0	1,696.40	TONS
FRESH APPLES	1,224.0	308.07	TONS
PROCESSING APPLES	1,647.0	228.05	TONS
APRICOTS	12,316.0	232.14	TONS
AVOCADOS	988.0	1,005.34	TONS
FIGS	12,925.0	331.30	TONS
GRAPEFRUIT	936.0	282.72	TONS
TABLE GRAPES	67,903.0	320.80	TONS
RAISIN GRAPES	267,762.0	281.07	TONS
WINE GRAPES	203,101.0	295.25	TONS
FRESH LEMONS	2,378.0	279.24	TONS
PROCESSING LEMONS	5,257.0	49.25	TONS
NECTARINES	14,601.0	390.69	TONS
OLIVES	26,034.0	477.76	TONS
FRESH ORANGES	91,134.0	216.75	TONS
PROCESSING ORANGES	39,903.0	51.41	TONS
PEACHES	47,947.0	197.65	TONS
PISTACHIOS	26,410.0	1,719.63	TONS
PLUMS	25,751.0	518.39	TONS
PRUNES	5,707.0	628.06	TONS
WALNUTS	72,376.0	1,578.03	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)

1985

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	66,680.0	422,800.0
207	3,332.4	6,727.0
208	115,300.0	405,627.0
209	90,185.8	83,410.0
210	168,200.0	360,278.0
211	24,309.7	0.0
212	251,300.0	82,588.0
213	310,800.0	239,660.0
214	189,500.0	4,807.0
215	393,800.0	63,723.0
216	0.0	952,415.0
233	94,280.0	395,770.0
234	9,966.4	9,827.0
235	447,400.0	34,168.0
236	254,600.0	262,808.0
237	283,700.0	247,587.0
238	267,300.0	193,772.0
239	123,800.0	168,079.0
240	82,210.0	28,283.9
241	269,900.0	406,455.0
242	748,700.0	526,505.0
243	492,100.0	355,240.0
244	220,500.0	1,036,057.0
245	68,690.0	20,135.0
246	10,120.0	67,798.0
254	187,500.0	477,431.0
255	402,900.0	265,653.0
256	318,629.3	327,471.0
257	5,012.1	63,371.0
258	0.0	236,427.0
259	0.0	353,848.0
260	0.0	4,000.0
261	50,980.0	158,781.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,631.0	0.0	0.0	12,381.0	1,235.0	0.0
207	1,731.0	15,203.0	0.0	0.0	0.0	0.0
208	3,681.0	0.0	0.0	0.0	0.0	357.0
209	3,382.0	30,017.0	0.0	0.0	1,205.0	0.0
210	0.0	13,356.0	0.0	12,628.0	0.0	0.0
211	2,421.0	8,247.0	0.0	0.0	0.0	0.0
212	5,301.0	0.0	0.0	2,740.0	1,597.0	9,095.0
213	0.0	3,163.9	3,920.0	0.0	0.0	544.0
214	10,736.0	19,556.0	0.0	0.0	0.0	0.0
215	4,034.2	7,957.0	6,370.0	742.0	0.0	7,131.0
216	7,461.0	0.0	0.0	4,202.0	1,803.0	16,286.0
233	0.0	3,964.0	0.0	253.0	0.0	0.0
234	1,461.0	1,753.0	0.0	0.0	0.0	0.0
235	0.0	9,400.0	0.0	0.0	0.0	1,337.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	2,424.0	27,578.0	0.0	0.0	0.0	2,013.0
238	0.0	16,878.0	0.0	545.0	229.8	392.0
239	2,605.0	9,742.0	0.0	0.0	0.0	680.0
240	1,080.0	487.0	0.0	0.0	0.0	0.0
241	0.0	56,544.0	0.0	290.0	0.0	4,970.0
242	7,220.0	44,103.0	0.0	905.0	0.0	1,388.0
243	14,125.0	38,966.0	0.0	3,170.0	14,632.0	854.0
244	0.0	0.0	0.0	0.0	0.0	5,253.0
245	0.0	1,926.3	0.0	0.0	0.0	0.0
246	2,784.0	16,294.0	0.0	0.0	0.0	0.0
254	0.0	0.0	0.0	1,650.0	0.0	1,145.0
255	0.0	16,600.0	0.0	0.0	0.0	2,289.0
256	11,690.0	0.0	0.0	0.0	0.0	458.0
257	2,473.0	24,354.0	0.0	0.0	0.0	0.0
258	0.0	4,286.0	0.0	0.0	0.0	727.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	746.2
261	0.0	0.0	0.0	0.0	0.0	770.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	11,518.5	0.0	22,325.0	0.0	3,040.0
207	0.0	0.0	0.0	313.0	0.0	0.0
208	0.0	6,765.7	0.0	37,674.0	4,197.0	16,860.0
209	0.0	0.0	0.0	2,801.0	3,260.0	790.0
210	0.0	0.0	35,060.0	0.0	1,601.0	6,740.0
211	0.0	0.0	0.0	598.0	0.0	180.0
212	488.0	14,279.2	0.0	13,881.0	1,767.0	14,390.0
213	0.0	0.0	58,246.0	0.0	1,484.0	17,295.0
214	0.0	0.0	5,419.0	0.0	1,000.0	500.0
215	0.0	0.0	37,788.0	4,315.0	2,211.0	27,205.0
216	488.0	0.0	73,017.0	25,857.0	28,607.0	35,500.0
233	0.0	1,398.9	29,730.0	4,222.0	886.0	8,945.0
234	0.0	0.0	0.0	670.0	0.0	0.0
235	0.0	0.0	47,545.0	6,147.0	2,039.0	29,656.0
236	0.0	0.0	4,156.0	0.0	546.0	64.8
237	1,327.0	0.0	64,899.0	8,673.0	995.0	31,090.0
238	3,700.0	0.0	77,455.0	0.0	0.0	18,885.0
239	0.0	0.0	15,356.0	2,824.4	668.0	6,722.0
240	0.0	0.0	0.0	0.0	0.0	153.0
241	22,500.0	0.0	124,726.6	0.0	0.0	1,924.0
242	0.0	0.0	123,500.0	0.0	4,540.0	40,687.0
243	0.0	0.0	109,391.0	0.0	12,745.0	25,167.0
244	0.0	0.0	277,394.0	0.0	4,317.0	563.8
245	0.0	0.0	15,311.0	0.0	0.0	3,917.0
246	0.0	0.0	4,478.0	147.1	1,815.0	482.0
254	3,280.0	0.0	127,819.0	0.0	0.0	32,544.0
255	0.0	0.0	100,706.0	0.0	0.0	31,242.0
256	0.0	0.0	68,829.0	0.0	0.0	16,103.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	25,751.0	0.0	0.0	3,336.0
259	0.0	0.0	54,686.3	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	42,830.8	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1985

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	964.0	0.0	321.0	396.0	321.0	12,563.0
233	525.0	0.0	210.0	262.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	315.0	0.0	157.0	157.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	525.0	1,102.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	945.0	0.0	210.0	315.0	1,154.0	945.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	1,034.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	3,705.0	0.0	0.0	2,309.0	0.0
259	0.0	3,411.0	0.0	0.0	661.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	3,705.0	0.0	0.0	525.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,714.0	0.0	0.0	0.0	535.0
211	0.0	0.0	0.0	0.0	0.0	268.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	2,893.0	6,961.0	2,570.0	1,071.0	2,892.0	0.0
233	630.0	1,737.0	840.0	0.0	0.0	262.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,225.0	0.0	0.0	0.0	262.0
236	419.0	0.0	1,049.0	0.0	0.0	205.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,620.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	1,947.0	0.0	0.0	0.0	472.0
244	3,096.0	9,208.0	525.0	525.0	1,259.0	262.0
245	525.0	2,624.0	525.0	0.0	0.0	210.0
246	331.0	0.0	0.0	157.0	157.0	0.0
254	509.0	0.0	840.0	0.0	0.0	0.0
255	0.0	0.0	3,148.0	0.0	0.0	0.0
256	0.0	0.0	2,571.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	525.0	2,624.0	0.0	0.0	0.0	0.0
259	3,936.0	2,330.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	4,754.0	4,838.0	4,093.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1985

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,253.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	7,101.0	0.0	720.0	5,704.0
211	0.0	0.0	0.0	0.0	493.0	0.0
212	0.0	0.0	0.0	0.0	3,823.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	2,508.0
215	0.0	0.0	0.0	0.0	0.0	6,702.0
216	0.0	0.0	0.0	1,071.0	2,528.0	20,223.0
233	0.0	0.0	0.0	0.0	222.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	569.0	0.0
236	0.0	0.0	315.0	840.0	145.0	2,545.0
237	0.0	0.0	0.0	0.0	465.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	157.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	105.0	1,349.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	945.0	1,914.0	33,656.0
245	0.0	0.0	0.0	0.0	0.0	1,178.0
246	0.0	0.0	0.0	0.0	0.0	1,264.0
254	105.0	1,921.0	0.0	0.0	0.0	1,602.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	168.0	3,180.0	0.0	0.0	0.0	2,631.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	787.0	18,996.0	0.0	0.0	0.0	3,546.0
259	0.0	0.0	0.0	0.0	0.0	1,602.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	262.0	693.0	0.0	0.0	0.0	2,631.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1985

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	19,827.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,937.0	0.0	0.0	0.0	0.0	0.0	0.0
208	40,765.0	0.0	0.0	0.0	0.0	0.0	0.0
209	21,371.0	610.0	1,220.0	0.0	0.0	0.0	0.0
210	30,635.0	0.0	0.0	0.0	0.0	978.0	0.0
211	2,113.0	0.0	0.0	0.0	0.0	0.0	0.0
212	5,878.0	0.0	0.0	0.0	0.0	0.0	0.0
213	19,929.0	0.0	0.0	0.0	0.0	915.0	0.0
214	7,909.0	0.0	0.0	0.0	0.0	3,607.0	0.0
215	2,092.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,604.0	0.0	0.0	9,569.0	0.0	0.0	0.0
233	8,985.0	0.0	0.0	0.0	0.0	4,627.0	0.0
234	1,053.0	0.0	0.0	0.0	0.0	770.0	0.0
235	4,113.0	0.0	0.0	0.0	0.0	0.0	0.0
236	3,937.0	0.0	0.0	0.0	0.0	0.0	0.0
237	1,917.0	0.0	0.0	0.0	0.0	0.0	0.0
238	175.0	0.0	0.0	0.0	0.0	0.0	0.0
239	943.0	0.0	0.0	0.0	0.0	0.0	0.0
240	440.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	988.0	0.0	0.0
243	7,165.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,437.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,510.0	0.0	0.0	2,747.0	0.0	0.0	0.0
254	1,800.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,410.0	0.0	0.0	0.0	0.0	0.0	0.0
256	29,700.0	614.0	427.0	0.0	0.0	1,352.0	0.0
257	11,090.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,100.0	0.0	0.0	0.0	0.0	676.0	0.0
259	16,300.0	0.0	0.0	0.0	0.0	0.0	0.0
260	500.0	0.0	0.0	0.0	0.0	0.0	0.0
261	680.0	0.0	0.0	0.0	0.0	0.0	936.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,596.0	0.0	10,918.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,517.0	0.0	12,288.0	0.0	0.0	0.0	0.0
209	2,374.0	0.0	9,494.0	0.0	0.0	0.0	0.0
210	9,488.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	4,007.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	36,743.0	10,918.0	0.0	0.0	0.0	550.0
214	0.0	4,612.0	21,836.0	0.0	0.0	0.0	1,200.0
215	0.0	5,038.0	15,667.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	46,253.0	0.0	177.0	181.0	2,799.0	2,705.0
234	0.0	1,015.0	0.0	0.0	0.0	0.0	0.0
235	0.0	18,016.0	0.0	0.0	0.0	0.0	0.0
236	0.0	107,258.0	0.0	0.0	0.0	5,965.0	0.0
237	0.0	6,454.0	0.0	0.0	0.0	0.0	0.0
238	216.0	1,297.0	818.0	0.0	0.0	291.0	0.0
239	4,701.0	6,178.0	11,780.0	0.0	0.0	3,259.0	1,560.0
240	4,701.0	1,081.0	6,039.0	208.0	315.0	397.0	4,993.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	3,424.0	15,967.0	56,022.0	416.0	740.0	1,370.0	8,181.0
243	16,317.0	0.0	0.0	416.0	774.0	0.0	1,649.0
244	6,270.0	0.0	0.0	0.0	0.0	0.0	619.0
245	0.0	0.0	955.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	832.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	211.0	17,850.0	812.0	0.0	0.0	0.0	0.0
256	5,524.0	0.0	23,252.0	208.0	637.0	520.0	936.0
257	505.0	0.0	0.0	416.0	940.0	0.0	0.0
258	4,474.0	0.0	0.0	208.0	488.0	0.0	0.0
259	1,076.0	0.0	22,302.0	0.0	0.0	0.0	2,809.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	502.0	0.0	0.0	329.0	1,182.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1985

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	6,215.0	0.0	0.0	0.0	13,270.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	7,603.0	0.0	0.0	0.0	5,783.0
209	0.0	0.0	2,313.0	0.0	0.0	0.0	652.0
210	0.0	0.0	8,644.0	0.0	0.0	0.0	526.0
211	0.0	0.0	0.0	2,314.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,314.0	0.0	0.0	0.0
213	0.0	0.0	2,219.0	0.0	899.0	0.0	931.0
214	2,850.0	100.0	463.0	5,433.0	0.0	0.0	647.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,441.0	0.0	0.0	0.0	7,256.0
233	2,474.0	885.0	1,763.0	752.0	2,081.0	1,040.0	2,799.0
234	1,410.0	653.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,742.0	0.0	0.0	0.0	0.0
236	366.0	218.0	4,405.0	752.0	2,809.0	0.0	6,308.0
237	0.0	0.0	0.0	0.0	0.0	0.0	811.0
238	0.0	0.0	624.0	0.0	1,040.0	0.0	4,452.0
239	3,990.0	1,572.0	4,989.0	0.0	8,333.0	0.0	0.0
240	10,999.0	4,613.0	755.0	0.0	835.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	36,604.0	15,532.0	1,040.0	0.0	4,993.0	3,206.0	20,775.0
243	13,630.0	5,829.0	0.0	2,665.0	2,764.0	1,461.0	7,511.0
244	0.0	0.0	0.0	1,079.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	390.0	270.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	6,762.0	3,953.0	952.0	3,123.0	1,040.0	0.0	447.0
257	6,431.0	3,499.0	0.0	0.0	0.0	0.0	0.0
258	3,204.0	1,893.0	936.0	3,940.0	957.0	0.0	208.0
259	1,019.0	455.0	0.0	4,038.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	1,005.0	431.0	843.0	0.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 1
1990

TABLE 6.2.3

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,161,314.5
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,011,007.8
TOTAL GROUND WATER USED (AC-FT)	5,179,703.0
TOTAL SURFACE WATER USED (AC-FT)	8,929,628.0
CONSUMER SURPLUS	$ 813,975,296.0
NET FARM INCOME	$2,614,914,560.0

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	70,304.6	5.53	CWTS
BARLEY	355,362.3	5.34	CWTS
OATS	6,243.0	5.05	CWTS
RICE	38,059.9	9.92	CWTS
SORGHUM	6,275.0	4.57	CWTS
SUGAR BEETS	51,758.2	45.05	TONS
SAFFLOWER	28,479.0	231.88	TONS
IRRIGATED PASTURE	28,786.1	127.61	ACRES
COTTON	1,506,693.3	319.59	BALES
CORN	127,132.9	5.46	CWTS
DRY BEANS	71,617.0	29.53	CWTS
ALFALFA	390,370.8	78.12	TONS
SNAPBEANS	2,859.0	639.15	TONS
CARROTS	12,268.0	13.35	CWTS
FALL CAULIFLOWER	1,477.0	33.20	CWTS
OTHER CAULIFLOWER	2,318.0	35.76	CWTS
GARLIC	5,149.0	350.60	TONS
LIMA BEANS	14,169.0	411.63	TONS
LETTUCE	18,275.0	250.88	TONS
CANTALOUPS	39,283.0	300.60	TONS
ONIONS	16,765.0	161.42	TONS
FRESH PEAS	1,831.0	614.25	TONS
PROCESSING PEAS	4,502.0	224.07	TONS
BELL PEPPERS	2,577.0	25.81	CWTS
WINTER POTATOES	1,479.0	8.60	CWTS
SPRING POTATOES	27,053.0	7.77	CWTS
SWEET POTATOES	9,098.0	354.81	TONS
SPINACH	2,635.9	75.64	TONS
FRESH TOMATOES	11,536.0	587.16	TONS
PROCESSING TOMATOES	93,670.0	62.06	TONS
ALMONDS	275,556.0	1,868.49	TONS
FRESH APPLES	1,264.0	329.06	TONS
PROCESSING APPLES	1,703.0	248.99	TONS
APRICOTS	12,743.0	231.72	TONS
AVOCADOS	1,018.0	1,238.91	TONS
FIGS	13,346.0	327.20	TONS
GRAPEFRUIT	964.0	320.82	TONS
TABLE GRAPES	71,975.0	326.64	TONS
RAISIN GRAPES	283,828.0	300.57	TONS
WINE GRAPES	215,288.0	330.14	TONS
FRESH LEMONS	2,450.0	303.56	TONS
PROCESSING LEMONS	5,415.0	60.76	TONS
NECTARINES	15,040.0	428.33	TONS
OLIVES	26,762.0	566.51	TONS
FRESH ORANGES	93,782.0	218.26	TONS
PROCESSING ORANGES	41,098.0	56.06	TONS
PEACHES	49,557.0	213.43	TONS
PISTACHIOS	27,262.0	1,901.64	TONS
PLUMS	26,530.0	575.67	TONS
PRUNES	5,878.0	643.39	TONS
WALNUTS	74,723.0	1,703.35	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)

1990

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	19,889.0	473,482.0
207	2,951.0	7,226.0
208	57,880.0	459,252.0
209	91,901.4	83,676.0
210	115,100.0	416,526.0
211	21,985.7	0.0
212	208,400.0	123,315.0
213	284,500.0	271,545.0
214	189,611.2	4,802.0
215	381,600.0	69,989.0
216	0.0	961,920.0
233	119,100.0	391,253.0
234	10,384.6	9,849.0
235	436,000.0	34,245.0
236	199,100.0	322,404.0
237	215,000.0	302,817.0
238	261,200.0	188,410.0
239	112,800.0	185,340.0
240	96,150.0	18,778.8
241	224,500.0	404,278.0
242	556,800.0	701,944.0
243	411,100.0	440,233.0
244	246,900.0	1,038,863.0
245	71,440.0	11,303.0
246	17,600.0	56,997.0
254	166,200.0	473,536.0
255	303,100.0	352,476.0
256	248,236.8	350,656.0
257	5,196.9	64,279.0
258	0.0	236,106.0
259	0.0	372,012.0
260	0.0	4,000.0
261	35,090.0	168,106.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1990

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,579.0	0.0	0.0	12,381.0	1,210.0	0.0
207	1,696.0	14,899.0	0.0	0.0	0.0	0.0
208	3,607.0	0.0	0.0	0.0	0.0	357.0
209	3,314.0	29,417.0	0.0	0.0	0.0	0.0
210	0.0	13,089.0	0.0	12,628.0	0.0	0.0
211	2,372.0	8,082.0	0.0	0.0	0.0	0.0
212	5,195.0	0.0	0.0	2,740.0	1,565.0	9,095.0
213	0.0	0.0	0.0	203.9	0.0	544.0
214	10,521.0	19,165.0	0.0	0.0	0.0	0.0
215	0.0	7,797.0	6,243.0	742.0	0.0	7,131.0
216	7,312.0	0.0	0.0	4,202.0	1,767.0	16,286.0
233	0.0	3,900.0	0.0	253.0	0.0	0.0
234	1,438.0	1,725.0	0.0	0.0	0.0	0.0
235	0.0	9,249.0	0.0	0.0	0.0	1,056.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	2,385.0	27,137.0	0.0	0.0	0.0	1,590.0
238	0.0	16,608.0	0.0	545.0	0.0	310.0
239	2,563.0	9,586.0	0.0	0.0	1,733.0	537.0
240	1,063.0	479.0	0.0	0.0	0.0	0.0
241	0.0	55,639.0	0.0	290.0	0.0	3,926.0
242	7,105.0	43,397.0	0.0	905.0	0.0	1,097.0
243	13,899.0	38,343.0	0.0	3,170.0	0.0	675.0
244	0.0	0.0	0.0	0.0	0.0	4,150.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	2,740.0	16,033.0	0.0	0.0	0.0	0.0
254	0.0	0.0	0.0	0.0	0.0	904.0
255	0.0	15,453.0	0.0	0.0	0.0	1,809.0
256	81.6	0.0	0.0	0.0	0.0	362.0
257	2,434.0	23,964.0	0.0	0.0	0.0	0.0
258	0.0	1,400.4	0.0	0.0	0.0	574.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	746.2
261	0.0	0.0	0.0	0.0	0.0	609.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	9,742.9	0.0	23,441.0	0.0	3,040.0
207	0.0	0.0	0.0	329.0	0.0	0.0
208	0.0	3,504.1	0.0	39,558.0	4,096.0	16,860.0
209	0.0	0.0	0.0	2,941.0	3,182.0	790.0
210	0.0	0.0	36,813.0	0.0	1,562.0	6,740.0
211	0.0	0.0	0.0	0.0	0.0	180.0
212	476.0	13,157.9	0.0	14,575.0	1,724.0	14,390.0
213	0.0	0.0	61,159.0	0.0	1,448.0	17,295.0
214	0.0	0.0	3,343.0	0.0	976.0	500.0
215	0.0	0.0	39,678.0	1,377.1	2,158.0	27,205.0
216	476.0	0.0	76,668.0	27,150.0	27,920.0	35,500.0
233	0.0	2,381.2	30,117.0	4,222.0	886.0	8,713.0
234	0.0	0.0	0.0	670.0	0.0	0.0
235	0.0	0.0	48,163.0	6,147.0	2,039.0	28,885.0
236	0.0	0.0	0.0	0.0	546.0	0.0
237	1,327.0	0.0	65,742.0	5,567.7	995.0	30,281.0
238	3,700.0	0.0	78,462.0	0.0	0.0	18,394.0
239	0.0	0.0	15,556.0	1,155.1	668.0	6,547.0
240	0.0	0.0	0.0	0.0	0.0	149.0
241	22,500.0	0.0	114,660.0	0.0	0.0	1,874.0
242	0.0	0.0	125,106.0	0.0	4,540.0	39,629.0
243	0.0	0.0	110,813.0	0.0	12,745.0	24,513.0
244	0.0	0.0	255,512.4	0.0	4,317.0	24,649.0
245	0.0	0.0	15,510.0	0.0	0.0	2,704.8
246	0.0	0.0	3,615.9	0.0	1,815.0	470.0
254	0.0	0.0	129,480.0	0.0	0.0	31,698.0
255	0.0	0.0	102,016.0	0.0	0.0	30,430.0
256	0.0	0.0	69,724.0	0.0	0.0	15,684.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	26,086.0	0.0	0.0	3,250.0
259	0.0	0.0	58,283.6	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	40,185.9	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	1,012.0	0.0	337.0	416.0	337.0	13,191.0
233	543.0	0.0	217.0	272.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	326.0	0.0	163.0	163.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	543.0	1,141.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	978.0	0.0	217.0	326.0	1,195.0	978.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	1,070.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	3,834.0	0.0	0.0	2,390.0	0.0
259	0.0	3,530.0	0.0	0.0	684.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	3,834.0	0.0	0.0	543.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,799.0	0.0	0.0	0.0	562.0
211	0.0	0.0	0.0	0.0	0.0	281.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	3,037.0	7,310.0	2,699.0	1,125.0	3,036.0	0.0
233	652.0	1,798.0	869.0	0.0	0.0	272.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,303.0	0.0	0.0	0.0	272.0
236	433.0	0.0	1,086.0	0.0	0.0	212.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,677.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	2,015.0	0.0	0.0	0.0	489.0
244	3,204.0	9,531.0	543.0	543.0	1,303.0	272.0
245	543.0	2,716.0	543.0	0.0	0.0	217.0
246	342.0	0.0	0.0	163.0	163.0	0.0
254	527.0	0.0	869.0	0.0	0.0	0.0
255	0.0	0.0	3,259.0	0.0	0.0	0.0
256	0.0	0.0	2,661.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	543.0	2,716.0	0.0	0.0	0.0	0.0
259	4,073.0	2,411.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	4,921.0	5,007.0	4,236.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,316.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	7,456.0	0.0	756.0	6,160.0
211	0.0	0.0	0.0	0.0	517.0	0.0
212	0.0	0.0	0.0	0.0	4,015.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	2,708.0
215	0.0	0.0	0.0	0.0	0.0	7,239.0
216	0.0	0.0	0.0	1,125.0	2,654.0	21,841.0
233	0.0	0.0	0.0	0.0	230.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	589.0	0.0
236	0.0	0.0	326.0	532.9	150.0	2,800.0
237	0.0	0.0	0.0	0.0	481.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	163.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	109.0	1,396.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	978.0	1,981.0	37,022.0
245	0.0	0.0	0.0	0.0	0.0	1,296.0
246	0.0	0.0	0.0	0.0	0.0	1,391.0
254	109.0	1,988.0	0.0	0.0	0.0	1,762.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	174.0	3,291.0	0.0	0.0	0.0	2,894.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	815.0	19,661.0	0.0	0.0	0.0	3,901.0
259	0.0	0.0	0.0	0.0	0.0	1,762.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	272.0	717.0	0.0	0.0	0.0	2,894.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	20,343.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,987.0	0.0	0.0	0.0	0.0	0.0	0.0
208	41,825.0	0.0	0.0	0.0	0.0	0.0	0.0
209	21,927.0	632.0	1,264.0	0.0	0.0	0.0	0.0
210	31,431.0	0.0	0.0	0.0	0.0	1,013.0	0.0
211	2,168.0	0.0	0.0	0.0	0.0	0.0	0.0
212	6,031.0	0.0	0.0	0.0	0.0	0.0	0.0
213	20,447.0	0.0	0.0	0.0	0.0	948.0	0.0
214	8,115.0	0.0	0.0	0.0	0.0	3,737.0	0.0
215	2,147.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,880.0	0.0	0.0	9,913.0	0.0	0.0	0.0
233	8,985.0	0.0	0.0	0.0	0.0	4,766.0	0.0
234	1,053.0	0.0	0.0	0.0	0.0	793.0	0.0
235	4,113.0	0.0	0.0	0.0	0.0	0.0	0.0
236	3,937.0	0.0	0.0	0.0	0.0	0.0	0.0
237	1,917.0	0.0	0.0	0.0	0.0	0.0	0.0
238	175.0	0.0	0.0	0.0	0.0	0.0	0.0
239	943.0	0.0	0.0	0.0	0.0	0.0	0.0
240	440.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	1,018.0	0.0	0.0
243	7,165.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,437.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,510.0	0.0	0.0	2,830.0	0.0	0.0	0.0
254	1,800.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,410.0	0.0	0.0	0.0	0.0	0.0	0.0
256	29,700.0	632.0	439.0	0.0	0.0	1,393.0	0.0
257	11,090.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,100.0	0.0	0.0	0.0	0.0	696.0	0.0
259	16,300.0	0.0	0.0	0.0	0.0	0.0	0.0
260	500.0	0.0	0.0	0.0	0.0	0.0	0.0
261	680.0	0.0	0.0	0.0	0.0	0.0	964.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1990

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,692.0	0.0	11,573.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,668.0	0.0	13,026.0	0.0	0.0	0.0	0.0
209	2,516.0	0.0	10,064.0	0.0	0.0	0.0	0.0
210	10,057.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	4,247.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	38,948.0	11,573.0	0.0	0.0	0.0	550.0
214	0.0	4,888.0	23,146.0	0.0	0.0	0.0	1,200.0
215	0.0	5,340.0	16,607.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	49,028.0	0.0	182.0	186.0	2,883.0	2,786.0
234	0.0	1,076.0	0.0	0.0	0.0	0.0	0.0
235	0.0	19,097.0	0.0	0.0	0.0	0.0	0.0
236	0.0	113,694.0	0.0	0.0	0.0	6,144.0	0.0
237	0.0	6,841.0	0.0	0.0	0.0	0.0	0.0
238	229.0	1,375.0	868.0	0.0	0.0	300.0	0.0
239	4,983.0	6,549.0	12,486.0	0.0	0.0	3,357.0	1,607.0
240	4,983.0	1,146.0	6,401.0	214.0	325.0	409.0	5,143.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	3,630.0	16,925.0	59,384.0	429.0	762.0	1,411.0	8,426.0
243	17,297.0	0.0	0.0	429.0	797.0	0.0	1,698.0
244	6,646.0	0.0	0.0	0.0	0.0	0.0	638.0
245	0.0	0.0	1,012.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	857.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	223.0	18,921.0	861.0	0.0	0.0	0.0	0.0
256	5,855.0	0.0	24,647.0	214.0	656.0	536.0	964.0
257	535.0	0.0	0.0	429.0	969.0	0.0	0.0
258	4,742.0	0.0	0.0	214.0	503.0	0.0	0.0
259	1,140.0	0.0	23,640.0	0.0	0.0	0.0	2,893.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	532.0	0.0	0.0	339.0	1,217.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	6,438.0	0.0	0.0	0.0	13,748.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	7,876.0	0.0	0.0	0.0	5,992.0
209	0.0	0.0	2,397.0	0.0	0.0	0.0	675.0
210	0.0	0.0	8,955.0	0.0	0.0	0.0	545.0
211	0.0	0.0	0.0	2,397.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,397.0	0.0	0.0	0.0
213	0.0	0.0	2,299.0	0.0	931.0	0.0	964.0
214	2,850.0	100.0	479.0	5,628.0	0.0	0.0	670.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,492.0	0.0	0.0	0.0	7,517.0
233	2,548.0	912.0	1,816.0	775.0	2,143.0	1,072.0	2,883.0
234	1,452.0	673.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,824.0	0.0	0.0	0.0	0.0
236	377.0	225.0	4,537.0	775.0	2,893.0	0.0	6,498.0
237	0.0	0.0	0.0	0.0	0.0	0.0	836.0
238	0.0	0.0	643.0	0.0	1,072.0	0.0	4,586.0
239	4,109.0	1,619.0	5,139.0	0.0	8,583.0	0.0	0.0
240	11,329.0	4,751.0	778.0	0.0	860.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	37,702.0	15,998.0	1,072.0	0.0	5,143.0	3,302.0	21,398.0
243	14,039.0	6,004.0	0.0	2,745.0	2,847.0	1,504.0	7,736.0
244	0.0	0.0	0.0	1,111.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	402.0	279.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	6,965.0	4,072.0	980.0	3,216.0	1,072.0	0.0	461.0
257	6,624.0	3,603.0	0.0	0.0	0.0	0.0	0.0
258	3,300.0	1,950.0	964.0	4,058.0	986.0	0.0	214.0
259	1,050.0	468.0	0.0	4,160.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	1,035.0	444.0	868.0	0.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 1
1995

TABLE 6.2.4

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,134,325.0
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,058,716.8
TOTAL GROUND WATER USED (AC-FT)	7,661,429.0
TOTAL SURFACE WATER USED (AC-FT)	6,501,963.0
CONSUMER SURPLUS	$ 877,264,128.0
NET FARM INCOME	$2,956,269,568.0

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	62,786.3	5.54	CWTS
BARLEY	340,666.1	5.44	CWTS
OATS	0.0	5.09	CWTS
RICE	42,267.6	10.71	CWTS
SORGHUM	4,456.0	4.57	CWTS
SUGAR BEETS	50,016.0	45.05	TONS
SAFFLOWER	28,455.0	231.88	TONS
IRRIGATED PASTURE	25,661.9	132.35	ACRES
COTTON	1,482,701.0	326.89	BALES
CORN	130,495.6	5.44	CWTS
DRY BEANS	69,995.0	31.78	CWTS
ALFALFA	379,891.9	83.07	TONS
SNAPBEANS	3,052.0	657.25	TONS
CARROTS	13,214.0	14.39	CWTS
FALL CAULIFLOWER	1,582.0	36.61	CWTS
OTHER CAULIFLOWER	2,483.0	39.16	CWTS
GARLIC	5,537.0	368.12	TONS
LIMA BEANS	14,904.0	410.95	TONS
LETTUCE	19,601.0	269.32	TONS
CANTALOUPS	42,060.0	329.22	TONS
ONIONS	17,984.0	175.20	TONS
FRESH PEAS	1,941.0	633.52	TONS
PROCESSING PEAS	4,767.0	242.09	TONS
BELL PEPPERS	2,749.0	26.67	CWTS
WINTER POTATOES	1,590.0	8.78	CWTS
SPRING POTATOES	29,135.0	7.93	CWTS
SWEET POTATOES	9,211.0	377.36	TONS
SPINACH	2,234.0	81.77	TONS
FRESH TOMATOES	12,208.0	642.47	TONS
PROCESSING TOMATOES	101,476.0	58.68	TONS
ALMONDS	278,451.3	2,026.70	TONS
FRESH APPLES	1,304.0	348.01	TONS
PROCESSING APPLES	1,757.0	267.91	TONS
APRICOTS	13,156.0	230.87	TONS
AVOCADOS	1,048.0	1,449.85	TONS
FIGS	13,764.0	323.12	TONS
GRAPEFRUIT	993.0	355.22	TONS
TABLE GRAPES	75,575.0	329.18	TONS
RAISIN GRAPES	298,018.0	318.49	TONS
WINE GRAPES	226,054.0	361.78	TONS
FRESH LEMONS	2,523.0	325.44	TONS
PROCESSING LEMONS	5,577.0	71.12	TONS
NECTARINES	15,493.0	461.80	TONS
OLIVES	28,389.0	630.84	TONS
FRESH ORANGES	97,547.0	216.99	TONS
PROCESSING ORANGES	42,147.0	59.18	TONS
PEACHES	51,134.0	227.56	TONS
PISTACHIOS	27,313.0	2,068.16	TONS
PLUMS	27,328.0	626.17	TONS
PRUNES	6,055.0	659.55	TONS
WALNUTS	77,057.0	1,832.27	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)

1995

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	30,900.0	465,952.0
207	3,049.6	7,233.0
208	64,760.0	448,665.0
209	95,253.7	83,681.0
210	141,900.0	411,742.0
211	23,237.8	0.0
212	229,100.0	114,353.0
213	481,000.0	111,713.0
214	189,566.7	4,802.0
215	392,100.0	60,789.0
216	3,078.4	974,266.0
233	222,000.0	294,554.0
234	10,907.7	9,877.0
235	439,100.0	33,182.0
236	375,900.0	167,753.0
237	369,700.0	147,417.0
238	347,300.0	107,661.0
239	225,600.0	79,019.0
240	99,490.0	19,743.0
241	429,000.0	214,383.0
242	993,000.0	261,357.0
243	620,000.0	257,849.0
244	280,700.0	1,042,163.0
245	72,110.0	9,426.0
246	33,560.0	24,494.7
254	387,600.0	247,511.0
255	472,000.0	172,537.0
256	426,386.3	193,091.0
257	8,881.0	63,189.5
258	51,370.0	179,832.0
259	0.0	216,527.0
260	0.0	4,000.0
261	82,090.0	133,992.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,579.0	0.0	0.0	13,928.0	1,210.0	0.0
207	1,696.0	14,899.0	0.0	0.0	0.0	0.0
208	3,607.0	0.0	0.0	0.0	0.0	386.0
209	3,314.0	29,417.0	0.0	0.0	0.0	0.0
210	0.0	9,327.9	0.0	14,206.0	0.0	0.0
211	2,372.0	8,082.0	0.0	0.0	0.0	0.0
212	5,195.0	0.0	0.0	3,082.0	1,565.0	9,823.0
213	0.0	0.0	0.0	336.0	0.0	588.0
214	10,521.0	19,165.0	0.0	0.0	0.0	0.0
215	0.0	7,797.0	0.0	824.6	0.0	7,702.0
216	3,542.3	0.0	0.0	4,728.0	0.0	17,589.0
233	0.0	3,783.0	0.0	253.0	0.0	0.0
234	1,395.0	1,674.0	0.0	0.0	0.0	0.0
235	0.0	8,972.0	0.0	0.0	0.0	792.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	2,313.0	26,323.0	0.0	0.0	0.0	1,193.0
238	0.0	16,110.0	0.0	545.0	0.0	233.0
239	2,486.0	9,298.0	0.0	0.0	1,681.0	403.0
240	1,031.0	465.0	0.0	0.0	0.0	0.0
241	0.0	53,970.0	0.0	290.0	0.0	2,945.0
242	6,892.0	42,096.0	0.0	905.0	0.0	823.0
243	13,482.0	37,193.0	0.0	3,170.0	0.0	506.0
244	0.0	0.0	0.0	0.0	0.0	3,113.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	15,552.0	0.0	0.0	0.0	0.0
254	0.0	0.0	0.0	0.0	0.0	678.0
255	0.0	13,297.2	0.0	0.0	0.0	1,356.0
256	0.0	0.0	0.0	0.0	0.0	271.0
257	2,361.0	23,245.0	0.0	0.0	0.0	0.0
258	0.0	0.0	0.0	0.0	0.0	431.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	728.0
261	0.0	0.0	0.0	0.0	0.0	456.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	10,710.1	0.0	24,496.0	0.0	3,040.0
207	0.0	0.0	0.0	343.0	0.0	0.0
208	0.0	1,013.8	0.0	41,338.0	3,994.0	16,860.0
209	0.0	0.0	0.0	3,074.0	3,102.0	790.0
210	0.0	0.0	39,390.0	0.0	1,523.0	6,740.0
211	0.0	0.0	0.0	0.0	0.0	180.0
212	464.0	13,401.8	0.0	15,231.0	1,681.0	14,390.0
213	0.0	0.0	57,685.8	0.0	1,412.0	17,295.0
214	0.0	0.0	0.0	0.0	952.0	500.0
215	0.0	0.0	42,455.0	0.0	2,104.0	27,205.0
216	464.0	0.0	82,034.0	28,372.0	27,222.0	35,500.0
233	0.0	536.3	30,719.0	4,222.0	886.0	8,425.0
234	0.0	0.0	0.0	670.0	0.0	0.0
235	0.0	0.0	49,127.0	6,137.4	2,039.0	27,932.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	1,327.0	0.0	67,057.0	5,731.0	995.0	29,282.0
238	3,700.0	0.0	80,031.0	0.0	0.0	17,787.0
239	0.0	0.0	15,867.0	881.2	668.0	6,331.0
240	0.0	0.0	0.0	0.0	0.0	144.0
241	22,500.0	0.0	119,836.6	0.0	0.0	1,812.0
242	0.0	0.0	122,700.7	0.0	4,540.0	38,321.0
243	0.0	0.0	113,029.0	0.0	12,745.0	23,704.0
244	0.0	0.0	262,553.1	0.0	4,317.0	23,836.0
245	0.0	0.0	13,793.9	0.0	0.0	3,689.0
246	0.0	0.0	0.0	0.0	1,815.0	454.0
254	0.0	0.0	132,070.0	0.0	0.0	30,652.0
255	0.0	0.0	104,056.0	0.0	0.0	29,426.0
256	0.0	0.0	71,118.0	0.0	0.0	15,167.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	26,607.0	0.0	0.0	429.9
259	0.0	0.0	9,730.7	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	42,841.2	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1995

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	1,063.0	0.0	354.0	437.0	354.0	13,851.0
233	585.0	0.0	234.0	292.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	351.0	0.0	175.0	175.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	585.0	1,228.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	1,053.0	0.0	234.0	351.0	1,287.0	1,053.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	1,152.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	4,130.0	0.0	0.0	2,574.0	0.0
259	0.0	3,802.0	0.0	0.0	737.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	4,130.0	0.0	0.0	585.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,889.0	0.0	0.0	0.0	590.0
211	0.0	0.0	0.0	0.0	0.0	295.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	3,189.0	7,675.0	2,834.0	1,181.0	3,188.0	0.0
233	702.0	1,936.0	936.0	0.0	0.0	292.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,480.0	0.0	0.0	0.0	292.0
236	467.0	0.0	1,170.0	0.0	0.0	228.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,806.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	2,170.0	0.0	0.0	0.0	526.0
244	3,451.0	10,264.0	585.0	585.0	1,404.0	292.0
245	585.0	2,925.0	585.0	0.0	0.0	234.0
246	369.0	0.0	0.0	175.0	175.0	0.0
254	567.0	0.0	936.0	0.0	0.0	0.0
255	0.0	0.0	3,510.0	0.0	0.0	0.0
256	0.0	0.0	2,866.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	585.0	2,925.0	0.0	0.0	0.0	0.0
259	4,387.0	2,597.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	5,299.0	5,393.0	4,562.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,382.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	7,829.0	0.0	793.0	7,023.0
211	0.0	0.0	0.0	0.0	543.0	0.0
212	0.0	0.0	0.0	0.0	4,215.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	3,087.0
215	0.0	0.0	0.0	0.0	0.0	8,252.0
216	0.0	0.0	0.0	1,181.0	2,787.0	24,899.0
233	0.0	0.0	0.0	0.0	248.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	634.0	0.0
236	0.0	0.0	0.0	0.0	161.0	0.0
237	0.0	0.0	0.0	0.0	518.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	175.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	117.0	1,503.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	1,053.0	2,134.0	40,724.0
245	0.0	0.0	0.0	0.0	0.0	1,426.0
246	0.0	0.0	0.0	0.0	0.0	1,530.0
254	117.0	2,141.0	0.0	0.0	0.0	1,938.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	187.0	3,545.0	0.0	0.0	0.0	3,184.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	877.0	21,174.0	0.0	0.0	0.0	4,291.0
259	0.0	0.0	0.0	0.0	0.0	1,938.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	292.0	772.0	0.0	0.0	0.0	3,184.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	20,343.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,987.0	0.0	0.0	0.0	0.0	0.0	0.0
208	41,825.0	0.0	0.0	0.0	0.0	0.0	0.0
209	21,927.0	653.0	1,305.0	0.0	0.0	0.0	0.0
210	31,431.0	0.0	0.0	0.0	0.0	1,047.0	0.0
211	2,168.0	0.0	0.0	0.0	0.0	0.0	0.0
212	6,031.0	0.0	0.0	0.0	0.0	0.0	0.0
213	20,447.0	0.0	0.0	0.0	0.0	979.0	0.0
214	8,115.0	0.0	0.0	0.0	0.0	3,860.0	0.0
215	2,147.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,880.0	0.0	0.0	10,241.0	0.0	0.0	0.0
233	9,344.0	0.0	0.0	0.0	0.0	4,909.0	0.0
234	1,095.0	0.0	0.0	0.0	0.0	817.0	0.0
235	4,278.0	0.0	0.0	0.0	0.0	0.0	0.0
236	2,659.3	0.0	0.0	0.0	0.0	0.0	0.0
237	1,994.0	0.0	0.0	0.0	0.0	0.0	0.0
238	182.0	0.0	0.0	0.0	0.0	0.0	0.0
239	981.0	0.0	0.0	0.0	0.0	0.0	0.0
240	458.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	1,048.0	0.0	0.0
243	7,452.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,654.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,650.0	0.0	0.0	2,915.0	0.0	0.0	0.0
254	1,872.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,586.0	0.0	0.0	0.0	0.0	0.0	0.0
256	30,888.0	651.0	452.0	0.0	0.0	1,435.0	0.0
257	11,534.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,344.0	0.0	0.0	0.0	0.0	717.0	0.0
259	16,952.0	0.0	0.0	0.0	0.0	0.0	0.0
260	520.0	0.0	0.0	0.0	0.0	0.0	0.0
261	707.0	0.0	0.0	0.0	0.0	0.0	993.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,777.0	0.0	12,152.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,801.0	0.0	13,677.0	0.0	0.0	0.0	0.0
209	2,642.0	0.0	10,567.0	0.0	0.0	0.0	0.0
210	10,560.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	4,460.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	40,895.0	12,152.0	0.0	0.0	0.0	825.0
214	0.0	5,133.0	24,303.0	0.0	0.0	0.0	1,800.0
215	0.0	5,607.0	17,438.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	51,479.0	0.0	188.0	192.0	2,970.0	2,870.0
234	0.0	1,130.0	0.0	0.0	0.0	0.0	0.0
235	0.0	20,052.0	0.0	0.0	0.0	0.0	0.0
236	0.0	119,378.0	0.0	0.0	0.0	6,328.0	0.0
237	0.0	7,183.0	0.0	0.0	0.0	0.0	0.0
238	241.0	1,444.0	911.0	0.0	0.0	309.0	0.0
239	5,232.0	6,876.0	13,111.0	0.0	0.0	3,458.0	1,655.0
240	5,232.0	1,203.0	6,721.0	221.0	334.0	422.0	5,298.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	3,811.0	17,771.0	62,353.0	441.0	785.0	1,454.0	8,679.0
243	18,161.0	0.0	0.0	441.0	821.0	0.0	1,749.0
244	6,978.0	0.0	0.0	0.0	0.0	0.0	657.0
245	0.0	0.0	1,063.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	883.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	235.0	19,867.0	904.0	0.0	0.0	0.0	0.0
256	6,148.0	0.0	25,880.0	221.0	675.0	552.0	993.0
257	562.0	0.0	0.0	441.0	998.0	0.0	0.0
258	4,980.0	0.0	0.0	221.0	518.0	0.0	0.0
259	1,197.0	0.0	24,822.0	0.0	0.0	0.0	2,980.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	558.0	0.0	0.0	349.0	1,254.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1995

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	6,651.0	0.0	0.0	0.0	14,202.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	8,136.0	0.0	0.0	0.0	6,189.0
209	0.0	0.0	2,476.0	0.0	0.0	0.0	698.0
210	0.0	0.0	9,250.0	0.0	0.0	0.0	563.0
211	0.0	0.0	0.0	2,476.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,476.0	0.0	0.0	0.0
213	0.0	0.0	2,374.0	0.0	962.0	0.0	996.0
214	4,275.0	150.0	495.0	5,814.0	0.0	0.0	692.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,542.0	0.0	0.0	0.0	7,765.0
233	2,624.0	939.0	1,871.0	798.0	2,207.0	1,104.0	2,970.0
234	1,495.0	693.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,909.0	0.0	0.0	0.0	0.0
236	0.0	0.0	4,673.0	0.0	2,980.0	0.0	6,693.0
237	0.0	0.0	0.0	0.0	0.0	0.0	861.0
238	0.0	0.0	662.0	0.0	1,104.0	0.0	4,724.0
239	4,233.0	1,668.0	5,293.0	0.0	8,840.0	0.0	0.0
240	11,669.0	4,894.0	801.0	0.0	886.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	38,833.0	16,478.0	1,104.0	0.0	5,298.0	3,401.0	22,040.0
243	14,460.0	6,184.0	0.0	2,827.0	2,932.0	1,550.0	7,968.0
244	0.0	0.0	0.0	1,145.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	414.0	287.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	7,174.0	4,194.0	1,010.0	3,313.0	1,104.0	0.0	475.0
257	6,823.0	3,712.0	0.0	0.0	0.0	0.0	0.0
258	3,399.0	2,009.0	993.0	4,180.0	1,015.0	0.0	221.0
259	1,082.0	482.0	0.0	4,284.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	1,066.0	457.0	894.0	0.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 1
2000

TABLE 6.2.5

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,094,595.5
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,080,853.3
TOTAL GROUND WATER USED (AC-FT)	10,855,792.0
TOTAL SURFACE WATER USED (AC-FT)	3,176,338.5
CONSUMER SURPLUS	$ 918,491,904.0
NET FARM INCOME	$3,297,098,752.0

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	58,346.0	5.54	CWTS
BARLEY	322,192.2	5.59	CWTS
OATS	0.0	5.09	CWTS
RICE	47,191.1	11.58	CWTS
SORGHUM	3,644.1	4.57	CWTS
SUGAR BEETS	49,578.9	45.05	TONS
SAFFLOWER	28,433.0	231.89	TONS
IRRIGATED PASTURE	20,818.5	137.70	ACRES
COTTON	1,479,494.3	326.95	BALES
CORN	125,469.0	5.47	CWTS
DRY BEANS	68,944.0	34.23	CWTS
ALFALFA	374,776.0	88.26	TONS
SNAPBEANS	3,258.0	676.99	TONS
CARROTS	14,232.0	15.54	CWTS
FALL CAULIFLOWER	1,695.0	40.37	CWTS
OTHER CAULIFLOWER	2,664.0	42.91	CWTS
GARLIC	5,160.0	376.27	TONS
LIMA BEANS	15,677.0	452.31	TONS
LETTUCE	16,301.0	292.74	TONS
CANTALOUPS	45,041.0	360.70	TONS
ONIONS	19,293.0	190.51	TONS
FRESH PEAS	2,059.0	654.81	TONS
PROCESSING PEAS	5,049.0	262.07	TONS
BELL PEPPERS	2,940.0	27.62	CWTS
WINTER POTATOES	1,714.0	8.96	CWTS
SPRING POTATOES	31,380.0	8.08	CWTS
SWEET POTATOES	9,671.0	392.40	TONS
SPINACH	2,374.0	87.06	TONS
FRESH TOMATOES	12,924.0	703.67	TONS
PROCESSING TOMATOES	111,221.0	58.08	TONS
ALMONDS	262,502.0	2,261.59	TONS
FRESH APPLES	1,345.0	369.16	TONS
PROCESSING APPLES	1,814.0	288.79	TONS
APRICOTS	13,581.0	229.99	TONS
AVOCADOS	1,080.0	1,682.72	TONS
FIGS	14,193.0	318.93	TONS
GRAPEFRUIT	1,023.0	393.20	TONS
TABLE GRAPES	78,096.0	347.67	TONS
RAISIN GRAPES	312,919.0	338.52	TONS
WINE GRAPES	234,927.3	398.09	TONS
FRESH LEMONS	2,598.0	349.66	TONS
PROCESSING LEMONS	5,744.0	82.58	TONS
NECTARINES	15,955.0	499.19	TONS
OLIVES	27,405.0	749.51	TONS
FRESH ORANGES	101,367.0	216.55	TONS
PROCESSING ORANGES	42,984.0	66.08	TONS
PEACHES	52,762.0	243.28	TONS
PISTACHIOS	23,753.0	2,263.53	TONS
PLUMS	28,151.0	682.68	TONS
PRUNES	6,237.0	677.59	TONS
WALNUTS	75,475.3	1,992.19	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)

2000

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	277,200.0	231,350.0
207	5,452.9	4,894.0
208	335,900.0	179,073.0
209	143,675.0	38,560.0
210	406,800.0	160,741.0
211	26,565.1	0.0
212	308,700.0	32,224.0
213	566,500.0	19,250.0
214	208,800.4	4,498.0
215	408,900.0	48,002.0
216	254,337.3	739,010.0
233	346,100.0	175,370.0
234	17,860.0	7,419.0
235	455,000.0	21,526.0
236	429,000.0	101,678.0
237	425,100.0	93,306.0
238	388,300.0	65,651.0
239	288,600.0	18,799.0
240	105,000.0	18,703.2
241	571,700.0	111,685.0
242	1,123,000.0	103,945.0
243	757,700.0	93,301.0
244	779,900.0	590,067.0
245	28,610.1	2,282.0
246	62,440.0	0.0
254	569,200.0	33,822.0
255	581,200.0	47,470.0
256	580,600.0	24,162.0
257	19,050.0	55,704.6
258	154,900.0	78,844.0
259	0.0	81,306.0
260	0.0	4,000.0
261	181,700.0	37,698.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,579.0	0.0	0.0	15,669.0	1,210.0	0.0
207	1,696.0	14,899.0	0.0	0.0	0.0	0.0
208	3,607.0	0.0	0.0	0.0	0.0	416.0
209	3,314.0	29,417.0	0.0	0.0	0.0	0.0
210	0.0	2,276.2	0.0	15,982.0	0.0	0.0
211	2,372.0	8,082.0	0.0	0.0	0.0	0.0
212	5,195.0	0.0	0.0	3,468.0	1,565.0	10,608.0
213	0.0	0.0	0.0	378.0	0.0	635.0
214	10,521.0	19,165.0	0.0	0.0	0.0	0.0
215	0.0	7,797.0	0.0	939.0	0.0	8,318.0
216	0.0	0.0	0.0	5,319.0	0.0	18,996.0
233	0.0	3,670.0	0.0	253.0	0.0	0.0
234	1,353.0	1,623.0	0.0	0.0	0.0	0.0
235	0.0	8,703.0	0.0	0.0	0.0	594.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	2,244.0	25,533.0	0.0	0.0	0.0	895.0
238	0.0	15,627.0	0.0	545.0	0.0	174.0
239	2,412.0	9,019.0	0.0	0.0	869.1	302.0
240	1,000.0	451.0	0.0	0.0	0.0	0.0
241	0.0	52,351.0	0.0	290.0	0.0	2,208.0
242	6,685.0	40,833.0	0.0	905.0	0.0	617.0
243	13,078.0	36,077.0	0.0	3,170.0	0.0	379.0
244	0.0	0.0	0.0	0.0	0.0	2,334.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	15,086.0	0.0	0.0	0.0	0.0
254	0.0	0.0	0.0	273.1	0.0	509.0
255	0.0	9,035.0	0.0	0.0	0.0	1,017.0
256	0.0	0.0	0.0	0.0	0.0	203.0
257	2,290.0	22,548.0	0.0	0.0	0.0	0.0
258	0.0	0.0	0.0	0.0	0.0	323.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	708.9
261	0.0	0.0	0.0	0.0	0.0	342.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	8,760.6	0.0	25,599.0	0.0	3,040.0
207	0.0	0.0	0.0	359.0	0.0	0.0
208	0.0	0.0	0.0	43,198.0	3,894.0	16,860.0
209	0.0	0.0	0.0	3,212.0	3,025.0	790.0
210	0.0	0.0	42,147.0	0.0	1,485.0	6,740.0
211	0.0	0.0	0.0	686.0	0.0	180.0
212	453.0	11,292.6	0.0	15,916.0	1,639.0	14,390.0
213	0.0	0.0	53,997.1	0.0	1,376.0	17,295.0
214	0.0	0.0	0.0	0.0	928.0	500.0
215	0.0	0.0	40,899.1	0.0	2,051.0	27,205.0
216	453.0	0.0	87,777.0	19,189.8	26,541.0	35,500.0
233	0.0	0.0	31,333.0	4,222.0	886.0	8,147.0
234	0.0	765.4	0.0	670.0	0.0	0.0
235	0.0	0.0	50,109.0	6,147.0	2,039.0	27,010.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	1,327.0	0.0	68,398.0	6,270.2	995.0	28,316.0
238	3,700.0	0.0	81,632.0	0.0	0.0	17,200.0
239	0.0	0.0	16,184.0	0.0	668.0	6,122.0
240	0.0	0.0	0.0	0.0	0.0	140.0
241	22,500.0	0.0	130,883.0	0.0	0.0	1,752.0
242	0.0	0.0	111,512.8	0.0	4,540.0	37,057.0
243	0.0	0.0	115,290.0	0.0	12,745.0	22,922.0
244	0.0	0.0	271,591.0	0.0	4,317.0	23,049.0
245	0.0	0.0	0.0	0.0	0.0	3,567.0
246	0.0	0.0	993.2	0.0	1,815.0	439.0
254	0.0	0.0	134,711.0	0.0	0.0	29,640.0
255	0.0	0.0	106,137.0	0.0	0.0	28,455.0
256	0.0	0.0	72,540.0	0.0	0.0	14,666.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	21,836.2	0.0	0.0	3,039.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	41,524.7	0.0	0.0	755.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	1,116.0	0.0	372.0	459.0	372.0	14,543.0
233	630.0	0.0	252.0	315.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	378.0	0.0	189.0	189.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	630.0	1,323.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	1,134.0	0.0	252.0	378.0	1,386.0	1,134.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	1,241.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	4,448.0	0.0	0.0	2,772.0	0.0
259	0.0	4,095.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	4,448.0	0.0	0.0	630.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,984.0	0.0	0.0	0.0	620.0
211	0.0	0.0	0.0	0.0	0.0	310.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	3,349.0	8,059.0	2,976.0	1,240.0	3,348.0	0.0
233	756.0	2,085.0	1,008.0	0.0	0.0	315.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,671.0	0.0	0.0	0.0	315.0
236	503.0	0.0	1,260.0	0.0	0.0	246.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,945.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	2,337.0	0.0	0.0	0.0	567.0
244	3,717.0	11,055.0	630.0	630.0	1,512.0	315.0
245	630.0	3,150.0	630.0	0.0	0.0	252.0
246	397.0	0.0	0.0	189.0	189.0	0.0
254	611.0	0.0	1,008.0	0.0	0.0	0.0
255	0.0	0.0	3,780.0	0.0	0.0	0.0
256	0.0	0.0	3,087.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	630.0	3,150.0	0.0	0.0	0.0	0.0
259	0.0	2,797.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	5,708.0	5,808.0	4,914.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
2000

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,451.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	8,220.0	0.0	833.0	8,006.0
211	0.0	0.0	0.0	0.0	570.0	0.0
212	0.0	0.0	0.0	0.0	4,426.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	3,520.0
215	0.0	0.0	0.0	0.0	0.0	9,407.0
216	0.0	0.0	0.0	1,240.0	2,926.0	28,384.0
233	0.0	0.0	0.0	0.0	267.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	683.0	0.0
236	0.0	0.0	0.0	0.0	174.0	0.0
237	0.0	0.0	0.0	0.0	558.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	189.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	126.0	1,619.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	1,134.0	2,298.0	44,797.0
245	0.0	0.0	0.0	0.0	0.0	1,568.0
246	0.0	0.0	0.0	0.0	0.0	1,683.0
254	126.0	2,306.0	0.0	0.0	0.0	2,132.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	202.0	3,818.0	0.0	0.0	0.0	3,502.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	945.0	22,805.0	0.0	0.0	0.0	4,720.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	315.0	832.0	0.0	0.0	0.0	3,502.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
2000

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	20,343.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,987.0	0.0	0.0	0.0	0.0	0.0	0.0
208	41,825.0	0.0	0.0	0.0	0.0	0.0	0.0
209	21,927.0	674.0	1,348.0	0.0	0.0	0.0	0.0
210	31,431.0	0.0	0.0	0.0	0.0	1,081.0	0.0
211	2,168.0	0.0	0.0	0.0	0.0	0.0	0.0
212	6,031.0	0.0	0.0	0.0	0.0	0.0	0.0
213	20,447.0	0.0	0.0	0.0	0.0	1,011.0	0.0
214	8,115.0	0.0	0.0	0.0	0.0	3,987.0	0.0
215	2,147.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,880.0	0.0	0.0	10,579.0	0.0	0.0	0.0
233	9,718.0	0.0	0.0	0.0	0.0	5,056.0	0.0
234	1,139.0	0.0	0.0	0.0	0.0	841.0	0.0
235	4,449.0	0.0	0.0	0.0	0.0	0.0	0.0
236	0.0	0.0	0.0	0.0	0.0	0.0	0.0
237	2,073.0	0.0	0.0	0.0	0.0	0.0	0.0
238	189.0	0.0	0.0	0.0	0.0	0.0	0.0
239	1,020.0	0.0	0.0	0.0	0.0	0.0	0.0
240	476.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	1,080.0	0.0	0.0
243	7,750.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,881.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,796.0	0.0	0.0	3,002.0	0.0	0.0	0.0
254	1,947.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,770.0	0.0	0.0	0.0	0.0	0.0	0.0
256	32,124.0	671.0	466.0	0.0	0.0	1,478.0	0.0
257	11,995.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,598.0	0.0	0.0	0.0	0.0	739.0	0.0
259	0.0	0.0	0.0	0.0	0.0	0.0	0.0
260	541.0	0.0	0.0	0.0	0.0	0.0	0.0
261	735.0	0.0	0.0	0.0	0.0	0.0	1,023.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,865.0	0.0	12,759.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,941.0	0.0	14,361.0	0.0	0.0	0.0	0.0
209	2,774.0	0.0	11,096.0	0.0	0.0	0.0	0.0
210	11,088.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	4,683.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	42,940.0	12,759.0	0.0	0.0	0.0	1,238.0
214	0.0	5,390.0	25,519.0	0.0	0.0	0.0	2,700.0
215	0.0	5,887.0	18,310.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	54,053.0	0.0	193.0	198.0	3,059.0	2,956.0
234	0.0	1,186.0	0.0	0.0	0.0	0.0	0.0
235	0.0	21,054.0	0.0	0.0	0.0	0.0	0.0
236	0.0	125,347.0	0.0	0.0	0.0	6,518.0	0.0
237	0.0	7,542.0	0.0	0.0	0.0	0.0	0.0
238	253.0	1,516.0	957.0	0.0	0.0	318.0	0.0
239	5,494.0	7,220.0	13,766.0	0.0	0.0	3,561.0	1,705.0
240	5,494.0	1,264.0	7,057.0	227.0	344.0	434.0	5,456.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	4,002.0	18,660.0	65,471.0	455.0	808.0	1,497.0	8,940.0
243	19,069.0	0.0	0.0	455.0	846.0	0.0	1,802.0
244	7,327.0	0.0	0.0	0.0	0.0	0.0	676.0
245	0.0	0.0	1,116.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	909.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	246.0	20,860.0	949.0	0.0	0.0	0.0	0.0
256	6,455.0	0.0	27,174.0	227.0	696.0	568.0	1,023.0
257	590.0	0.0	0.0	455.0	1,028.0	0.0	0.0
258	5,229.0	0.0	0.0	227.0	533.0	0.0	0.0
259	0.0	0.0	23,633.3	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	586.0	0.0	0.0	359.0	1,291.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	6,870.0	0.0	0.0	0.0	14,671.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	8,405.0	0.0	0.0	0.0	6,394.0
209	0.0	0.0	2,557.0	0.0	0.0	0.0	721.0
210	0.0	0.0	9,556.0	0.0	0.0	0.0	581.0
211	0.0	0.0	0.0	2,558.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,558.0	0.0	0.0	0.0
213	0.0	0.0	2,453.0	0.0	994.0	0.0	1,029.0
214	6,413.0	225.0	511.0	6,006.0	0.0	0.0	715.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,593.0	0.0	0.0	0.0	8,021.0
233	2,703.0	967.0	1,927.0	822.0	2,274.0	1,137.0	3,059.0
234	1,540.0	714.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,997.0	0.0	0.0	0.0	0.0
236	0.0	0.0	4,813.0	0.0	3,069.0	0.0	2,908.3
237	0.0	0.0	0.0	0.0	0.0	0.0	887.0
238	0.0	0.0	682.0	0.0	1,137.0	0.0	4,865.0
239	4,359.0	1,718.0	5,452.0	0.0	9,105.0	0.0	0.0
240	12,019.0	5,040.0	825.0	0.0	913.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	39,998.0	16,972.0	1,137.0	0.0	5,456.0	3,504.0	22,701.0
243	14,894.0	6,369.0	0.0	2,912.0	3,020.0	1,596.0	8,207.0
244	0.0	0.0	0.0	1,179.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	426.0	296.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	7,389.0	4,320.0	1,040.0	3,412.0	1,137.0	0.0	489.0
257	7,027.0	3,823.0	0.0	0.0	0.0	0.0	0.0
258	3,501.0	2,069.0	1,023.0	4,306.0	1,046.0	0.0	227.0
259	0.0	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	1,098.0	471.0	921.0	0.0	0.0	0.0	0.0

TABLE 6.3.1

OUTPUT OF CONTROL MODEL
SCENARIO 2

1981

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)
206	8,157	14.00
207	13,450	63.00
208	52,150	10.00
209	99,670	93.00
210	100,200	17.00
211	34,490	130.00
212	194,800	39.00
213	340,700	86.00
214	164,500	104.00
215	297,000	70.00
216	0	128.00
233	97,540	67.00
234	14,200	115.00
235	391,000	67.00
236	171,600	42.00
237	231,400	63.00
238	308,000	73.00
239	95,360	23.00
240	84,860	38.00
241	396,400	60.00
242	585,500	71.00
243	385,800	114.00
244	141,200	360.00
245	81,520	312.00
246	41,850	114.00
254	327,500	169.00
255	398,100	134.00
256	294,700	181.00
257	10,610	388.00
258	27,640	528.00
259	0	220.00
261	98,980	562.00

TABLE 6.3.2

OUTPUT OF CONTROL MODEL
SCENARIO 2

1985

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	66,680	8.80	6,002.00
207	7,486	71.80	959.30
208	115,300	5.00	9,611.00
209	106,400	89.68	11,380.00
210	168,400	18.55	20,500.00
211	32,650	124.40	3,565.00
212	232,300	34.18	19,640.00
213	308,000	88.83	25,100.00
214	164,200	105.60	14,380.00
215	317,500	76.99	29,100.00
216	0	119.00	8,903.00
233	94,310	31.83	11,330.00
234	14,440	106.70	1,468.00
235	391,800	57.15	49,630.00
236	243,700	43.99	25,440.00
237	266,800	57.79	20,050.00
238	248,600	112.70	19,570.00
239	117,100	7.12	14,540.00
240	82,210	45.81	1,169.00
241	278,200	102.30	580.60
242	686,400	132.00	54,190.00
243	447,800	98.53	42,630.00
244	224,400	342.70	11,810.00
245	71,440	340.00	5,952.00
246	17,830	142.70	4,222.00
254	283,200	187.10	26,300.00
255	432,100	135.10	26,450.00
256	354,200	194.80	35,000.00
257	9,556	389.90	3,597.00
258	0	509.30	344.60
259	0	221.30	2,085.00
261	63,540	571.40	3,457.00

TABLE 6.3.3

OUTPUT OF CONTROL MODEL
SCENARIO 2

1990

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	19,940	5.78	4,239.00
207	2,950	74.86	822.10
208	57,940	5.00	8,241.00
209	106,800	86.62	15,560.00
210	115,300	13.89	20,390.00
211	31,930	122.00	4,959.00
212	192,000	30.95	24,300.00
213	283,500	89.05	38,290.00
214	167,800	104.30	22,260.00
215	309,300	87.37	41,650.00
216	0	119.10	12,010.00
233	119,100	5.07	21,020.00
234	14,320	87.41	2,084.00
235	381,800	51.91	75,220.00
236	170,400	37.21	32,250.00
237	200,100	52.11	25,060.00
238	245,900	99.74	30,830.00
239	106,100	5.00	23,320.00
240	96,140	43.88	2,379.00
241	180,000	88.63	11,380.00
242	500,200	165.70	83,050.00
243	370,800	89.43	67,880.00
244	256,300	348.80	20,590.00
245	68,030	379.60	8,564.00
246	6,489	133.80	7,674.00
254	153,600	205.30	31,280.00
255	273,100	136.80	28,600.00
256	259,300	196.80	42,310.00
257	9,015	394.50	5,994.00
258	0	490.80	702.90
259	0	220.70	38.68
261	23,150	572.20	2,390.00

TABLE 6.3.4

OUTPUT OF CONTROL MODEL
SCENARIO 2

1995

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	30,940	5.00	6,694.00
207	4,322	73.32	1,298.00
208	64,750	5.00	13,430.00
209	111,000	83.54	23,120.00
210	142,200	9.74	35,370.00
211	34,080	114.40	7,597.00
212	213,900	21.67	38,660.00
213	483,700	81.58	67,820.00
214	178,300	98.49	31,720.00
215	317,900	88.47	58,420.00
216	27,720	119.30	11,840.00
233	222,100	5.00	38,430.00
234	14,730	79.76	3,112.00
235	386,800	43.85	102,400.00
236	363,700	23.39	57,000.00
237	353,400	46.43	44,220.00
238	328,800	89.94	48,460.00
239	218,000	5.00	36,830.00
240	99,490	44.24	5,600.00
241	367,500	85.53	8,240.00
242	928,400	191.30	127,800.00
243	573,000	86.61	98,630.00
244	291,600	346.20	32,160.00
245	67,260	421.00	11,500.00
246	20,590	135.80	8,366.00
254	355,200	224.20	61,600.00
255	419,500	137.40	49,410.00
256	416,100	188.10	68,680.00
257	8,866	387.70	5,728.00
258	22,590	489.50	3,581.00
259	0	215.30	4,228.00
261	49,550	594.40	5,687.00

TABLE 6.3.5

OUTPUT OF CONTROL MODEL
SCENARIO 2

2000

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	276,900	7.11	43,190.00
207	6,726	76.01	1,912.00
208	332,900	5.00	51,050.00
209	156,600	85.18	38,080.00
210	407,000	8.37	84,410.00
211	36,230	111.90	11,220.00
212	297,300	18.34	60,600.00
213	572,400	93.72	111,700.00
214	192,900	103.10	48,800.00
215	367,400	93.93	91,480.00
216	274,100	123.90	20,530.00
233	346,100	5.00	74,450.00
234	17,880	82.60	4,946.00
235	426,900	42.87	125,500.00
236	420,800	21.34	85,920.00
237	417,400	45.78	80,400.00
238	376,900	93.21	61,500.00
239	283,200	5.98	60,930.00
240	105,000	44.79	9,414.00
241	495,300	92.10	37,820.00
242	1,053,000	202.30	193,500.00
243	730,300	97.48	156,000.00
244	792,400	338.60	92,000.00
245	61,270	471.30	14,670.00
246	26,920	142.90	11,320.00
254	467,200	247.30	98,730.00
255	462,600	136.50	73,220.00
256	553,000	183.60	112,600.00
257	19,060	386.90	4,429.00
258	109,100	503.00	16,440.00
259	0	203.80	5,171.00
261	65,100	621.30	10,060.00

TABLE 6.3.6

OUTPUT OF CONTROL MODEL
SCENARIO 2

2005

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	78,390	9.72	23,550.00
207	4,089	79.66	2,549.00
208	110,500	5.00	31,680.00
209	111,200	86.97	40,700.00
210	191,100	15.08	72,670.00
211	36,190	119.50	14,140.00
212	235,300	21.03	71,950.00
213	343,000	102.30	98,960.00
214	184,900	107.80	58,330.00
215	323,600	92.84	107,200.00
216	36,470	120.80	17,600.00
233	121,200	5.00	46,470.00
234	15,460	85.02	5,713.00
235	390,400	44.67	174,200.00
236	255,300	26.18	88,990.00
237	254,400	47.60	66,280.00
238	239,600	96.35	66,880.00
239	132,000	7.07	54,290.00
240	96,060	45.26	7,587.00
241	302,300	103.30	8,659.00
242	616,200	213.70	175,200.00
243	427,700	115.50	147,100.00
244	206,400	326.30	41,180.00
245	50,800	526.80	15,480.00
246	15,710	161.10	15,010.00
254	254,800	272.10	84,930.00
255	393,500	133.50	87,080.00
256	276,200	187.30	98,610.00
257	7,627	390.60	13,220.00
258	1,413	533.30	747.50
259	0	186.70	12,160.00
261	51,070	650.80	10,390.00

TABLE 6.3.7

OUTPUT OF CONTROL MODEL
SCENARIO 2

2010

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	26,470	6.69	15,390.00
207	3,898	78.44	3,028.00
208	56,370	5.00	24,600.00
209	111,400	84.56	49,000.00
210	138,800	11.13	69,540.00
211	36,080	121.90	17,030.00
212	197,200	21.37	77,040.00
213	314,900	98.46	127,700.00
214	185,000	107.40	75,210.00
215	317,300	94.77	132,400.00
216	36,720	120.30	23,150.00
233	130,200	5.00	65,150.00
234	15,500	82.40	6,966.00
235	391,800	43.80	229,500.00
236	180,100	23.32	99,490.00
237	201,200	45.03	78,590.00
238	240,800	91.19	90,390.00
239	115,400	5.00	72,490.00
240	96,070	44.09	7,382.00
241	224,400	101.60	21,590.00
242	437,800	220.60	231,900.00
243	350,400	112.40	200,200.00
244	188,300	326.50	49,780.00
245	43,140	586.30	16,050.00
246	11,910	168.40	23,240.00
254	106,000	284.50	73,080.00
255	288,400	127.00	87,930.00
256	250,900	174.40	123,800.00
257	7,732	385.90	15,860.00
258	0	550.60	2,774.00
259	0	169.10	17,030.00
261	47,970	669.20	12,060.00

TABLE 6.3 .8

OUTPUT OF CONTROL MODEL
SCENARIO 2

2015

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	45,050	5.00	24,160.00
207	4,720	75.03	3,879.00
208	66,010	5.00	35,700.00
209	111,800	82.10	60,260.00
210	153,700	8.67	94,400.00
211	36,330	116.30	20,940.00
212	209,200	14.59	99,220.00
213	481,100	88.03	174,400.00
214	185,300	101.70	84,770.00
215	327,700	92.73	157,200.00
216	38,190	119.70	24,890.00
233	229,000	5.00	101,600.00
234	15,530	79.93	8,478.00
235	396,400	38.27	259,800.00
236	349,400	14.24	139,600.00
237	358,500	40.62	123,100.00
238	329,000	81.60	122,000.00
239	221,800	5.00	95,860.00
240	96,050	43.98	15,520.00
241	394,300	92.55	34,400.00
242	858,700	230.00	305,300.00
243	545,100	106.10	245,800.00
244	220,600	315.80	64,310.00
245	36,100	645.00	16,230.00
246	13,760	172.00	21,520.00
254	295,000	286.80	135,300.00
255	415,700	118.60	131,000.00
256	401,700	157.40	174,800.00
257	8,238	370.30	16,230.00
258	15,190	565.60	6,435.00
259	3,616	149.30	20,550.00
261	48,360	675.20	14,750.00

TABLE 6.3.9

OUTPUT OF CONTROL MODEL
SCENARIO 2

2020

DAU	Pumpage (ac.ft.)	Pumping Depth (feet)	Social Cost ($/foot)
206	281,100	7.23	0.00
207	6,703	76.80	0.00
208	334,900	5.00	0.00
209	157,800	84.00	0.00
210	416,300	7.80	0.00
211	36,610	114.30	0.00
212	305,200	12.83	0.00
213	580,400	96.69	0.00
214	194,400	104.50	0.00
215	388,900	97.25	0.00
216	283,100	124.00	0.00
233	350,700	5.00	0.00
234	18,060	82.75	0.00
235	444,400	39.08	0.00
236	419,600	14.44	0.00
237	431,000	42.35	0.00
238	402,300	85.52	0.00
239	285,700	6.02	0.00
240	104,600	44.73	0.00
241	538,100	98.65	0.00
242	1,032,000	228.80	0.00
243	749,600	111.70	0.00
244	832,100	323.10	0.00
245	31,170	709.40	0.00
246	24,590	182.00	0.00
254	438,200	296.40	0.00
255	495,200	115.40	0.00
256	562,800	147.20	0.00
257	19,930	361.60	0.00
258	100,500	584.10	0.00
259	9,270	131.70	0.00
261	61,830	688.50	0.00

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 2, 1981

TABLE 6.4.1

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,072,255.0
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,038,689.8
TOTAL GROUND WATER USED (AC-FT)	5,610,300.0
TOTAL SURFACE WATER USED (AC-FT)	8,381,595.0
CONSUMER SURPLUS	$ 695,956,864.00
NET FARM INCOME	$2,215,143,424.00

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	101,117.8	5.49	CWTS
BARLEY	387,145.7	5.30	CWTS
OATS	10,500.0	5.02	CWTS
RICE	32,059.5	8.27	CWTS
SORGHUM	14,502.0	4.54	CWTS
SUGAR BEETS	62,357.2	49.73	TONS
SAFFLOWER	31,807.0	227.24	TONS
IRRIGATED PASTURE	32,274.5	118.01	ACRES
COTTON	1,470,215.5	370.81	BALES
CORN	141,511.3	5.38	CWTS
DRY BEANS	73,761.0	24.94	CWTS
ALFALFA	377,369.8	70.28	TONS
SNAPBEANS	2,642.0	600.66	TONS
CARROTS	11,452.0	10.71	CWTS
FALL CAULIFLOWER	1,371.0	26.09	CWTS
OTHER CAULIFLOWER	2,151.0	28.66	CWTS
GARLIC	4,798.0	322.54	TONS
LIMA BEANS	11,965.0	371.91	TONS
LETTUCE	16,979.0	211.62	TONS
CANTALOUPS	36,430.0	235.77	TONS
ONIONS	15,579.0	131.08	TONS
FRESH PEAS	1,679.0	573.54	TONS
PROCESSING PEAS	2,906.0	194.96	TONS
BELL PEPPERS	2,381.0	23.70	CWTS
WINTER POTATOES	1,377.0	8.29	CWTS
SPRING POTATOES	25,253.0	7.51	CWTS
SWEET POTATOES	8,260.0	325.60	TONS
SPINACH	1,831.0	68.50	TONS
FRESH TOMATOES	10,558.0	467.72	TONS
PROCESSING TOMATOES	78,586.0	60.52	TONS
ALMONDS	267,184.0	1,546.11	TONS
FRESH APPLES	1,185.0	289.61	TONS
PROCESSING APPLES	1,591.0	209.63	TONS
APRICOTS	11,903.0	232.99	TONS
AVOCADOS	959.0	799.89	TONS
FIGS	12,516.0	329.60	TONS
GRAPEFRUIT	909.0	249.21	TONS
TABLE GRAPES	64,058.0	307.53	TONS
RAISIN GRAPES	252,605.0	264.50	TONS
WINE GRAPES	191,606.0	264.90	TONS
FRESH LEMONS	2,309.0	257.90	TONS
PROCESSING LEMONS	4,580.9	40.15	TONS
NECTARINES	14,177.0	358.02	TONS
OLIVES	25,328.0	409.80	TONS
FRESH ORANGES	88,565.0	244.69	TONS
PROCESSING ORANGES	38,743.0	47.63	TONS
PEACHES	46,387.0	183.91	TONS
PISTACHIOS	25,585.0	1,559.78	TONS
PLUMS	24,997.0	468.89	TONS
PRUNES	5,541.0	615.10	TONS
WALNUTS	70,104.0	1,470.29	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)

1981

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	8,157.0	475,832.0
207	13,450.0	7,603.0
208	52,150.0	451,118.0
209	85,722.0	83,303.0
210	100,200.0	406,189.0
211	23,434.0	0.0
212	194,800.0	122,439.0
213	340,700.0	211,871.0
214	164,500.0	30,299.0
215	297,000.0	156,967.0
216	0.0	938,203.0
233	97,510.0	373,344.0
234	9,567.5	9,808.0
235	391,000.0	93,979.0
236	171,600.0	325,538.0
237	231,400.0	300,232.0
238	308,000.0	199,641.0
239	95,360.0	191,301.0
240	84,860.0	24,405.7
241	396,400.0	348,803.0
242	585,500.0	728,223.0
243	385,800.0	447,607.0
244	141,200.0	1,025,073.0
245	81,520.0	13,535.0
246	41,850.0	40,957.0
254	327,500.0	350,359.0
255	398,100.0	265,987.0
256	294,600.0	301,922.0
257	4,833.9	62,492.0
258	27,640.0	176,451.0
259	0.0	276,966.0
260	0.0	4,000.0
261	98,980.0	94,115.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,685.0	0.0	0.0	12,381.0	1,260.0	0.0
207	1,766.0	15,513.0	0.0	0.0	0.0	0.0
208	3,756.0	0.0	0.0	0.0	0.0	357.0
209	3,451.0	30,630.0	0.0	0.0	1,230.0	0.0
210	3,204.0	13,629.0	0.0	5,181.5	0.0	0.0
211	2,470.0	8,415.0	0.0	0.0	0.0	0.0
212	5,409.0	0.0	0.0	2,740.0	1,630.0	9,095.0
213	0.0	7,834.0	4,000.0	0.0	0.0	544.0
214	10,955.0	19,955.0	0.0	0.0	0.0	0.0
215	7,527.0	8,119.0	6,500.0	742.0	977.3	7,131.0
216	7,613.0	0.0	0.0	4,202.0	1,840.0	16,286.0
233	0.0	4,028.0	0.0	253.0	0.0	0.0
234	1,485.0	1,782.0	0.0	0.0	0.0	0.0
235	0.0	9,553.0	0.0	0.0	0.0	1,692.0
236	858.3	0.0	0.0	0.0	0.0	0.0
237	2,463.0	28,027.0	0.0	0.0	16.6	2,548.0
238	2,786.0	17,153.0	0.0	545.0	6,534.0	497.0
239	2,647.0	9,900.0	0.0	0.0	399.3	860.0
240	1,098.0	495.0	0.0	0.0	0.0	0.0
241	7,609.0	57,464.0	0.0	290.0	58.1	6,291.0
242	7,338.0	44,820.0	0.0	905.0	15.9	1,757.0
243	14,355.0	39,600.0	0.0	3,170.0	15.9	1,081.0
244	0.0	0.0	0.0	0.0	0.0	6,650.0
245	0.0	12,049.7	0.0	0.0	0.0	0.0
246	2,829.0	16,559.0	0.0	0.0	525.0	0.0
254	0.0	0.0	0.0	1,650.0	0.0	1,449.0
255	0.0	16,870.0	0.0	0.0	0.0	2,898.0
256	6,299.5	0.0	0.0	0.0	0.0	580.0
257	2,514.0	24,750.0	0.0	0.0	0.0	0.0
258	0.0	0.0	0.0	0.0	0.0	920.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	746.2
261	0.0	0.0	0.0	0.0	0.0	975.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	12,920.9	0.0	21,262.0	0.0	3,040.0
207	0.0	1,718.7	0.0	298.0	0.0	0.0
208	0.0	4,321.2	0.0	35,880.0	4,300.0	16,860.0
209	0.0	0.0	0.0	2,668.0	3,340.0	790.0
210	0.0	0.0	33,390.0	8,828.0	1,640.0	6,740.0
211	0.0	0.0	0.0	570.0	0.0	180.0
212	500.0	12,459.7	0.0	13,220.0	1,810.0	14,390.0
213	0.0	0.0	55,473.0	0.0	1,520.0	17,295.0
214	0.0	0.0	5,161.0	1,983.3	1,025.0	500.0
215	0.0	0.0	35,989.0	4,110.0	2,265.0	27,205.0
216	500.0	0.0	69,540.0	24,626.0	29,310.0	35,500.0
233	0.0	410.6	29,349.0	4,222.0	886.0	9,184.0
234	0.0	0.0	0.0	670.0	0.0	0.0
235	0.0	0.0	46,935.0	6,095.2	2,039.0	30,447.0
236	0.0	0.0	4,102.0	0.0	546.0	2,372.0
237	1,327.0	0.0	64,066.0	6,293.8	995.0	31,920.0
238	3,700.0	443.4	76,461.0	7,170.0	0.0	19,389.0
239	0.0	0.0	15,159.0	3,035.0	668.0	6,901.0
240	0.0	0.0	716.0	0.0	0.0	157.0
241	22,500.0	0.0	136,531.0	0.0	0.0	1,975.0
242	0.0	0.0	121,915.0	0.0	4,540.0	41,773.0
243	0.0	0.0	107,987.0	0.0	12,745.0	25,839.0
244	0.0	0.0	257,872.1	0.0	4,317.0	0.0
245	0.0	0.0	15,115.0	0.0	0.0	2,503.2
246	0.0	0.0	4,420.0	580.0	1,815.0	495.0
254	3,280.0	0.0	126,178.0	0.0	0.0	33,413.0
255	0.0	0.0	99,414.0	0.0	0.0	31,968.7
256	0.0	0.0	67,945.0	0.0	0.0	16,533.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	23,708.8	0.0	0.0	0.0
259	0.0	0.0	34,188.6	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	38,600.4	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	918.0	0.0	306.0	377.0	306.0	11,965.0
233	507.0	0.0	203.0	253.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	304.0	0.0	152.0	152.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	507.0	1,065.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	913.0	0.0	203.0	304.0	1,115.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	999.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	3,579.0	0.0	0.0	2,231.0	0.0
259	0.0	3,295.0	0.0	0.0	639.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	3,579.0	0.0	0.0	507.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,632.0	0.0	0.0	0.0	510.0
211	0.0	0.0	0.0	0.0	0.0	255.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	2,755.0	6,630.0	2,448.0	1,020.0	2,754.0	0.0
233	608.0	1,678.0	811.0	0.0	0.0	253.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,150.0	0.0	0.0	0.0	253.0
236	405.0	0.0	1,014.0	0.0	0.0	198.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,566.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	1,881.0	0.0	0.0	0.0	456.0
244	2,991.0	8,897.0	507.0	507.0	0.0	253.0
245	507.0	2,535.0	507.0	0.0	0.0	203.0
246	319.0	0.0	0.0	152.0	152.0	0.0
254	492.0	0.0	811.0	0.0	0.0	0.0
255	0.0	0.0	3,042.0	0.0	0.0	0.0
256	0.0	0.0	2,484.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	507.0	2,535.0	0.0	0.0	0.0	0.0
259	3,802.0	2,251.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	4,593.0	4,675.0	3,955.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,193.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	6,763.0	0.0	685.0	5,282.0
211	0.0	0.0	0.0	0.0	469.0	0.0
212	0.0	0.0	0.0	0.0	3,641.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	2,322.0
215	0.0	0.0	0.0	0.0	0.0	6,206.0
216	0.0	0.0	0.0	1,020.0	2,407.0	18,725.0
233	0.0	0.0	0.0	0.0	215.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	550.0	0.0
236	0.0	0.0	304.0	811.0	140.0	2,314.0
237	0.0	0.0	0.0	0.0	449.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	152.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	101.0	1,303.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	0.0	1,850.0	30,597.0
245	0.0	0.0	0.0	0.0	0.0	1,071.0
246	0.0	0.0	0.0	0.0	0.0	1,149.0
254	101.0	1,856.0	0.0	0.0	0.0	1,456.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	162.0	3,072.0	0.0	0.0	0.0	2,392.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	760.0	18,353.0	0.0	0.0	0.0	3,224.0
259	0.0	0.0	0.0	0.0	0.0	1,456.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	253.0	669.0	0.0	0.0	0.0	2,392.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	19,325.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,888.0	0.0	0.0	0.0	0.0	0.0	0.0
208	39,732.0	0.0	0.0	0.0	0.0	0.0	0.0
209	20,830.0	589.0	1,177.0	0.0	0.0	0.0	0.0
210	29,858.0	0.0	0.0	0.0	0.0	944.0	0.0
211	2,059.0	0.0	0.0	0.0	0.0	0.0	0.0
212	5,729.0	0.0	0.0	0.0	0.0	0.0	0.0
213	19,424.0	0.0	0.0	0.0	0.0	883.0	0.0
214	7,709.0	0.0	0.0	0.0	0.0	3,481.0	0.0
215	2,039.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,336.0	0.0	0.0	9,236.0	0.0	0.0	0.0
233	8,985.0	0.0	0.0	0.0	0.0	4,492.0	0.0
234	1,053.0	0.0	0.0	0.0	0.0	747.0	0.0
235	4,113.0	0.0	0.0	0.0	0.0	0.0	0.0
236	3,937.0	0.0	0.0	0.0	0.0	0.0	0.0
237	1,917.0	0.0	0.0	0.0	0.0	0.0	0.0
238	175.0	0.0	0.0	0.0	0.0	0.0	0.0
239	943.0	0.0	0.0	0.0	0.0	0.0	0.0
240	440.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	959.0	0.0	0.0
243	7,165.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,437.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,510.0	0.0	0.0	2,667.0	0.0	0.0	0.0
254	1,800.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,410.0	0.0	0.0	0.0	0.0	0.0	0.0
256	29,700.0	596.0	414.0	0.0	0.0	1,313.0	0.0
257	11,090.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,100.0	0.0	0.0	0.0	0.0	656.0	0.0
259	16,300.0	0.0	0.0	0.0	0.0	0.0	0.0
260	500.0	0.0	0.0	0.0	0.0	0.0	0.0
261	680.0	0.0	0.0	0.0	0.0	0.0	909.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,506.0	0.0	10,300.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,374.0	0.0	11,593.0	0.0	0.0	0.0	0.0
209	2,239.0	0.0	8,957.0	0.0	0.0	0.0	0.0
210	8,951.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	3,780.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	34,664.0	10,300.0	0.0	0.0	0.0	550.0
214	0.0	4,351.0	20,600.0	0.0	0.0	0.0	1,200.0
215	0.0	4,752.0	14,780.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	43,635.0	0.0	172.0	176.0	2,718.0	2,626.0
234	0.0	958.0	0.0	0.0	0.0	0.0	0.0
235	0.0	16,996.0	0.0	0.0	0.0	0.0	0.0
236	0.0	101,187.0	0.0	0.0	0.0	5,791.0	0.0
237	0.0	6,088.0	0.0	0.0	0.0	0.0	0.0
238	204.0	1,224.0	772.0	0.0	0.0	283.0	0.0
239	4,435.0	5,828.0	11,113.0	0.0	0.0	3,164.0	1,515.0
240	4,435.0	1,020.0	5,697.0	202.0	306.0	386.0	4,848.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	3,230.0	15,063.0	52,851.0	404.0	718.0	1,330.0	7,943.0
243	15,394.0	0.0	0.0	404.0	751.0	0.0	1,601.0
244	5,915.0	0.0	0.0	0.0	0.0	0.0	601.0
245	0.0	0.0	901.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	808.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	199.0	16,839.0	766.0	0.0	0.0	0.0	0.0
256	5,211.0	0.0	21,936.0	202.0	618.0	505.0	909.0
257	476.0	0.0	0.0	404.0	913.0	0.0	0.0
258	4,221.0	0.0	0.0	202.0	212.9	0.0	0.0
259	1,015.0	0.0	21,040.0	0.0	0.0	0.0	2,727.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	473.0	0.0	0.0	319.0	885.9	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1981

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	5,999.0	0.0	0.0	0.0	12,809.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	7,338.0	0.0	0.0	0.0	5,582.0
209	0.0	0.0	2,233.0	0.0	0.0	0.0	629.0
210	0.0	0.0	8,343.0	0.0	0.0	0.0	507.0
211	0.0	0.0	0.0	2,234.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,234.0	0.0	0.0	0.0
213	0.0	0.0	2,142.0	0.0	868.0	0.0	898.0
214	2,850.0	100.0	447.0	5,244.0	0.0	0.0	624.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,391.0	0.0	0.0	0.0	7,003.0
233	2,402.0	860.0	1,712.0	730.0	2,020.0	1,010.0	2,718.0
234	1,369.0	634.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,662.0	0.0	0.0	0.0	0.0
236	356.0	212.0	4,276.0	730.0	2,727.0	0.0	6,125.0
237	0.0	0.0	0.0	0.0	0.0	0.0	788.0
238	0.0	0.0	606.0	0.0	1,010.0	0.0	4,323.0
239	3,873.0	1,526.0	4,844.0	0.0	8,090.0	0.0	0.0
240	10,679.0	4,478.0	733.0	0.0	811.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	35,538.0	15,079.0	1,010.0	0.0	4,848.0	3,113.0	20,170.0
243	13,233.0	5,659.0	0.0	2,587.0	2,684.0	1,418.0	7,292.0
244	0.0	0.0	0.0	1,048.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	379.0	263.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	6,565.0	3,838.0	924.0	3,032.0	1,010.0	0.0	434.0
257	6,244.0	3,397.0	0.0	0.0	0.0	0.0	0.0
258	3,111.0	1,838.0	909.0	3,825.0	929.0	0.0	202.0
259	990.0	441.0	0.0	3,921.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	976.0	418.0	818.0	0.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 2, 1985

TABLE 6.4.2

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,144,513.0
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,011,139.5
TOTAL GROUND WATER USED (AC-FT)	5,943,236.0
TOTAL SURFACE WATER USED (AC-FT)	8,318,272.0
CONSUMER SURPLUS	$ 751,699,200.00
NET FARM INCOME	$2,306,524,160.00

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	90,570.4	5.50	CWTS
BARLEY	370,324.4	5.28	CWTS
OATS	10,290.0	5.02	CWTS
RICE	39,506.0	9.01	CWTS
SORGHUM	23,227.0	4.53	CWTS
SUGAR BEETS	56,435.2	44.87	TONS
SAFFLOWER	31,783.0	229.79	TONS
IRRIGATED PASTURE	35,982.5	122.05	ACRES
COTTON	1,521,938.0	319.23	BALES
CORN	130,358.1	5.43	CWTS
DRY BEANS	72,678.0	27.09	CWTS
ALFALFA	374,921.3	74.27	TONS
SNAPBEANS	2,749.0	618.64	TONS
CARROTS	11,855.0	11.94	CWTS
FALL CAULIFLOWER	1,423.0	29.42	CWTS
OTHER CAULIFLOWER	2,232.0	31.98	CWTS
GARLIC	4,970.0	333.90	TONS
LIMA BEANS	13,508.0	390.12	TONS
LETTUCE	17,618.0	229.98	TONS
CANTALOUPS	37,828.0	266.11	TONS
ONIONS	16,161.0	145.15	TONS
FRESH PEAS	1,753.0	592.57	TONS
PROCESSING PEAS	4,308.0	203.33	TONS
BELL PEPPERS	2,476.0	24.68	CWTS
WINTER POTATOES	1,427.0	8.44	CWTS
SPRING POTATOES	26,139.0	7.62	CWTS
SWEET POTATOES	8,669.0	338.78	TONS
SPINACH	2,856.0	69.71	TONS
FRESH TOMATOES	11,036.0	523.46	TONS
PROCESSING TOMATOES	85,792.0	60.84	TONS
ALMONDS	271,315.0	1,696.40	TONS
FRESH APPLES	1,224.0	308.07	TONS
PROCESSING APPLES	1,647.0	228.05	TONS
APRICOTS	12,316.0	232.14	TONS
AVOCADOS	988.0	1,005.34	TONS
FIGS	12,925.0	331.30	TONS
GRAPEFRUIT	936.0	282.72	TONS
TABLE GRAPES	67,903.0	320.80	TONS
RAISIN GRAPES	267,762.0	281.07	TONS
WINE GRAPES	203,101.0	295.25	TONS
FRESH LEMONS	2,378.0	279.24	TONS
PROCESSING LEMONS	5,257.0	49.25	TONS
NECTARINES	14,601.0	390.69	TONS
OLIVES	26,034.0	477.76	TONS
FRESH ORANGES	91,134.0	216.75	TONS
PROCESSING ORANGES	39,903.0	51.41	TONS
PEACHES	47,947.0	197.65	TONS
PISTACHIOS	26,410.0	1,719.63	TONS
PLUMS	25,751.0	518.39	TONS
PRUNES	5,707.0	628.06	TONS
WALNUTS	72,376.0	1,578.03	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)

1985

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	66,680.0	422,800.0
207	3,332.4	6,727.0
208	115,300.0	405,627.0
209	85,884.0	83,410.0
210	168,200.0	360,278.0
211	24,309.7	0.0
212	232,300.0	105,275.0
213	308,000.0	244,921.0
214	164,200.0	30,352.0
215	317,500.0	151,855.0
216	0.0	951,682.0
233	94,280.0	395,770.0
234	9,966.4	9,827.0
235	391,800.0	93,974.0
236	243,700.0	273,916.0
237	283,700.0	267,517.0
238	248,600.0	216,821.0
239	117,100.0	174,989.0
240	82,210.0	28,283.9
241	278,200.0	396,516.0
242	686,400.0	591,570.0
243	447,800.0	407,727.0
244	224,400.0	1,036,057.0
245	71,440.0	17,317.0
246	17,830.0	59,634.0
254	283,200.0	384,102.0
255	431,100.0	234,451.0
256	325,397.3	320,703.0
257	5,012.1	63,371.0
258	0.0	236,427.0
259	0.0	347,969.0
260	0.0	4,000.0
261	63,540.0	146,259.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,631.0	0.0	0.0	12,381.0	1,235.0	0.0
207	1,731.0	15,203.0	0.0	0.0	0.0	0.0
208	3,681.0	0.0	0.0	0.0	0.0	357.0
209	3,382.0	30,017.0	0.0	0.0	0.0	0.0
210	0.0	13,356.0	0.0	12,628.0	0.0	0.0
211	2,421.0	8,247.0	0.0	0.0	0.0	0.0
212	5,301.0	0.0	0.0	2,740.0	1,597.0	9,095.0
213	0.0	3,163.9	3,920.0	0.0	0.0	544.0
214	10,736.0	19,556.0	0.0	0.0	0.0	0.0
215	7,376.0	7,957.0	6,370.0	742.0	228.5	7,131.0
216	7,461.0	0.0	0.0	4,202.0	1,803.0	16,286.0
233	0.0	3,964.0	0.0	253.0	0.0	0.0
234	1,461.0	1,753.0	0.0	0.0	0.0	0.0
235	0.0	9,400.0	0.0	0.0	0.0	1,337.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	2,424.0	27,578.0	0.0	0.0	1,926.0	2,013.0
238	0.0	16,878.0	0.0	545.0	1,805.5	392.0
239	2,605.0	9,742.0	0.0	0.0	0.0	680.0
240	1,080.0	487.0	0.0	0.0	0.0	0.0
241	0.0	56,544.0	0.0	290.0	0.0	4,970.0
242	7,220.0	44,103.0	0.0	905.0	0.0	1,388.0
243	14,125.0	38,966.0	0.0	3,170.0	14,632.0	854.0
244	0.0	0.0	0.0	0.0	0.0	5,253.0
245	0.0	1,875.6	0.0	0.0	0.0	0.0
246	2,772.4	16,294.0	0.0	0.0	0.0	0.0
254	0.0	0.0	0.0	1,650.0	0.0	1,145.0
255	0.0	16,600.0	0.0	0.0	0.0	2,289.0
256	11,690.0	0.0	0.0	0.0	0.0	458.0
257	2,473.0	24,354.0	0.0	0.0	0.0	0.0
258	0.0	4,286.0	0.0	0.0	0.0	727.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	746.2
261	0.0	0.0	0.0	0.0	0.0	770.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1985

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	11,518.5	0.0	22,325.0	0.0	3,040.0
207	0.0	0.0	0.0	313.0	0.0	0.0
208	0.0	6,765.7	0.0	37,674.0	4,197.0	16,860.0
209	0.0	0.0	0.0	2,801.0	3,260.0	790.0
210	0.0	0.0	35,060.0	0.0	1,601.0	6,740.0
211	0.0	0.0	0.0	598.0	0.0	180.0
212	488.0	14,847.3	0.0	13,881.0	1,767.0	14,390.0
213	0.0	0.0	58,246.0	0.0	1,484.0	17,295.0
214	0.0	0.0	5,419.0	0.0	1,000.0	500.0
215	0.0	0.0	37,788.0	4,315.0	2,211.0	27,205.0
216	488.0	0.0	73,017.0	25,857.0	28,607.0	35,500.0
233	0.0	1,398.9	29,730.0	4,222.0	886.0	8,945.0
234	0.0	0.0	0.0	670.0	0.0	0.0
235	0.0	0.0	47,545.0	6,147.0	2,039.0	29,656.0
236	0.0	0.0	4,156.0	0.0	546.0	64.8
237	1,327.0	1,452.1	64,899.0	8,673.0	995.0	31,090.0
238	3,700.0	0.0	77,455.0	0.0	0.0	18,885.0
239	0.0	0.0	15,356.0	2,882.1	668.0	6,722.0
240	0.0	0.0	0.0	0.0	0.0	153.0
241	22,500.0	0.0	124,330.7	0.0	0.0	1,924.0
242	0.0	0.0	123,500.0	0.0	4,540.0	40,687.0
243	0.0	0.0	109,391.0	0.0	12,745.0	25,167.0
244	0.0	0.0	277,394.0	0.0	4,317.0	1,503.6
245	0.0	0.0	15,311.0	0.0	0.0	3,917.0
246	0.0	0.0	4,478.0	0.0	1,815.0	482.0
254	3,280.0	0.0	127,819.0	0.0	0.0	32,544.0
255	0.0	0.0	100,706.0	0.0	0.0	31,242.0
256	0.0	0.0	68,829.0	0.0	0.0	16,103.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	25,751.0	0.0	0.0	3,336.0
259	0.0	0.0	52,915.5	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	42,842.2	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	964.0	0.0	321.0	396.0	321.0	12,563.0
233	525.0	0.0	210.0	262.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	315.0	0.0	157.0	157.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	525.0	1,102.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	945.0	0.0	210.0	315.0	1,154.0	945.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	1,034.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	3,705.0	0.0	0.0	2,309.0	0.0
259	0.0	3,411.0	0.0	0.0	661.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	3,705.0	0.0	0.0	525.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,714.0	0.0	0.0	0.0	535.0
211	0.0	0.0	0.0	0.0	0.0	268.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	2,893.0	6,961.0	2,570.0	1,071.0	2,892.0	0.0
233	630.0	1,737.0	840.0	0.0	0.0	262.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,225.0	0.0	0.0	0.0	262.0
236	419.0	0.0	1,049.0	0.0	0.0	205.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,620.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	1,947.0	0.0	0.0	0.0	472.0
244	3,096.0	9,208.0	525.0	525.0	1,259.0	262.0
245	525.0	2,624.0	525.0	0.0	0.0	210.0
246	331.0	0.0	0.0	157.0	157.0	0.0
254	509.0	0.0	840.0	0.0	0.0	0.0
255	0.0	0.0	3,148.0	0.0	0.0	0.0
256	0.0	0.0	2,571.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	525.0	2,624.0	0.0	0.0	0.0	0.0
259	3,936.0	2,330.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	4,754.0	4,838.0	4,093.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1985

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,253.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	7,101.0	0.0	720.0	5,704.0
211	0.0	0.0	0.0	0.0	493.0	0.0
212	0.0	0.0	0.0	0.0	3,823.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	2,508.0
215	0.0	0.0	0.0	0.0	0.0	6,702.0
216	0.0	0.0	0.0	1,071.0	2,528.0	20,223.0
233	0.0	0.0	0.0	0.0	222.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	569.0	0.0
236	0.0	0.0	315.0	840.0	145.0	2,545.0
237	0.0	0.0	0.0	0.0	465.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	157.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	105.0	1,349.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	945.0	1,914.0	33,656.0
245	0.0	0.0	0.0	0.0	0.0	1,178.0
246	0.0	0.0	0.0	0.0	0.0	1,264.0
254	105.0	1,921.0	0.0	0.0	0.0	1,602.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	168.0	3,180.0	0.0	0.0	0.0	2,631.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	787.0	18,996.0	0.0	0.0	0.0	3,546.0
259	0.0	0.0	0.0	0.0	0.0	1,602.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	262.0	693.0	0.0	0.0	0.0	2,631.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	19,827.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,937.0	0.0	0.0	0.0	0.0	0.0	0.0
208	40,765.0	0.0	0.0	0.0	0.0	0.0	0.0
209	21,371.0	610.0	1,220.0	0.0	0.0	0.0	0.0
210	30,635.0	0.0	0.0	0.0	0.0	978.0	0.0
211	2,113.0	0.0	0.0	0.0	0.0	0.0	0.0
212	5,878.0	0.0	0.0	0.0	0.0	0.0	0.0
213	19,929.0	0.0	0.0	0.0	0.0	915.0	0.0
214	7,909.0	0.0	0.0	0.0	0.0	3,607.0	0.0
215	2,092.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,604.0	0.0	0.0	9,569.0	0.0	0.0	0.0
233	8,985.0	0.0	0.0	0.0	0.0	4,627.0	0.0
234	1,053.0	0.0	0.0	0.0	0.0	770.0	0.0
235	4,113.0	0.0	0.0	0.0	0.0	0.0	0.0
236	3,937.0	0.0	0.0	0.0	0.0	0.0	0.0
237	1,917.0	0.0	0.0	0.0	0.0	0.0	0.0
238	175.0	0.0	0.0	0.0	0.0	0.0	0.0
239	943.0	0.0	0.0	0.0	0.0	0.0	0.0
240	440.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	988.0	0.0	0.0
243	7,165.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,437.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,510.0	0.0	0.0	2,747.0	0.0	0.0	0.0
254	1,800.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,410.0	0.0	0.0	0.0	0.0	0.0	0.0
256	29,700.0	614.0	427.0	0.0	0.0	1,352.0	0.0
257	11,090.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,100.0	0.0	0.0	0.0	0.0	676.0	0.0
259	16,300.0	0.0	0.0	0.0	0.0	0.0	0.0
260	500.0	0.0	0.0	0.0	0.0	0.0	0.0
261	680.0	0.0	0.0	0.0	0.0	0.0	936.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,596.0	0.0	10,918.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,517.0	0.0	12,288.0	0.0	0.0	0.0	0.0
209	2,374.0	0.0	9,494.0	0.0	0.0	0.0	0.0
210	9,488.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	4,007.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	36,743.0	10,918.0	0.0	0.0	0.0	550.0
214	0.0	4,612.0	21,836.0	0.0	0.0	0.0	1,200.0
215	0.0	5,038.0	15,667.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	46,253.0	0.0	177.0	181.0	2,799.0	2,705.0
234	0.0	1,015.0	0.0	0.0	0.0	0.0	0.0
235	0.0	18,016.0	0.0	0.0	0.0	0.0	0.0
236	0.0	107,258.0	0.0	0.0	0.0	5,965.0	0.0
237	0.0	6,454.0	0.0	0.0	0.0	0.0	0.0
238	216.0	1,297.0	818.0	0.0	0.0	291.0	0.0
239	4,701.0	6,178.0	11,780.0	0.0	0.0	3,259.0	1,560.0
240	4,701.0	1,081.0	6,039.0	208.0	315.0	397.0	4,993.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	3,424.0	15,967.0	56,022.0	416.0	740.0	1,370.0	8,181.0
243	16,317.0	0.0	0.0	416.0	774.0	0.0	1,649.0
244	6,270.0	0.0	0.0	0.0	0.0	0.0	619.0
245	0.0	0.0	955.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	832.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	211.0	17,850.0	812.0	0.0	0.0	0.0	0.0
256	5,524.0	0.0	23,252.0	208.0	637.0	520.0	936.0
257	505.0	0.0	0.0	416.0	940.0	0.0	0.0
258	4,474.0	0.0	0.0	208.0	488.0	0.0	0.0
259	1,076.0	0.0	22,302.0	0.0	0.0	0.0	2,809.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	502.0	0.0	0.0	329.0	1,182.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1985

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	6,215.0	0.0	0.0	0.0	13,270.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	7,603.0	0.0	0.0	0.0	5,783.0
209	0.0	0.0	2,313.0	0.0	0.0	0.0	652.0
210	0.0	0.0	8,644.0	0.0	0.0	0.0	526.0
211	0.0	0.0	0.0	2,314.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,314.0	0.0	0.0	0.0
213	0.0	0.0	2,219.0	0.0	899.0	0.0	931.0
214	2,850.0	100.0	463.0	5,433.0	0.0	0.0	647.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,441.0	0.0	0.0	0.0	7,256.0
233	2,474.0	885.0	1,763.0	752.0	2,081.0	1,040.0	2,799.0
234	1,410.0	653.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,742.0	0.0	0.0	0.0	0.0
236	366.0	218.0	4,405.0	752.0	2,809.0	0.0	6,308.0
237	0.0	0.0	0.0	0.0	0.0	0.0	811.0
238	0.0	0.0	624.0	0.0	1,040.0	0.0	4,452.0
239	3,990.0	1,572.0	4,989.0	0.0	8,333.0	0.0	0.0
240	10,999.0	4,613.0	755.0	0.0	835.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	36,604.0	15,532.0	1,040.0	0.0	4,993.0	3,206.0	20,775.0
243	13,630.0	5,829.0	0.0	2,665.0	2,764.0	1,461.0	7,511.0
244	0.0	0.0	0.0	1,079.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	390.0	270.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	6,762.0	3,953.0	952.0	3,123.0	1,040.0	0.0	447.0
257	6,431.0	3,499.0	0.0	0.0	0.0	0.0	0.0
258	3,204.0	1,893.0	936.0	3,940.0	957.0	0.0	208.0
259	1,019.0	455.0	0.0	4,038.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	1,005.0	431.0	843.0	0.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 2, 1990

TABLE 6.4.3

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,162,219.5
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,023,787.5
TOTAL GROUND WATER USED (AC-FT)	4,823,838.0
TOTAL SURFACE WATER USED (AC-FT)	9,371,202.0
CONSUMER SURPLUS	$ 814,296,576.00
NET FARM INCOME	$2,623,625,728.00

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	71,456.2	5.53	CWTS
BARLEY	356,703.4	5.34	CWTS
OATS	6,243.0	5.05	CWTS
RICE	38,740.1	9.92	CWTS
SORGHUM	7,168.1	4.57	CWTS
SUGAR BEETS	51,758.2	45.05	TONS
SAFFLOWER	28,479.0	231.88	TONS
IRRIGATED PASTURE	29,465.1	127.55	ACRES
COTTON	1,509,952.0	319.57	BALES
CORN	131,578.1	5.44	CWTS
DRY BEANS	71,617.0	29.53	CWTS
ALFALFA	390,378.1	78.12	TONS
SNAPBEANS	2,859.0	639.15	TONS
CARROTS	12,268.0	13.35	CWTS
FALL CAULIFLOWER	1,477.0	33.20	CWTS
OTHER CAULIFLOWER	2,318.0	35.76	CWTS
GARLIC	5,149.0	350.60	TONS
LIMA BEANS	14,169.0	411.63	TONS
LETTUCE	18,275.0	250.88	TONS
CANTALOUPS	39,283.0	300.60	TONS
ONIONS	16,765.0	161.42	TONS
FRESH PEAS	1,831.0	614.25	TONS
PROCESSING PEAS	4,502.0	224.07	TONS
BELL PEPPERS	2,577.0	25.81	CWTS
WINTER POTATOES	1,479.0	8.60	CWTS
SPRING POTATOES	27,053.0	7.77	CWTS
SWEET POTATOES	9,098.0	354.81	TONS
SPINACH	2,635.9	75.64	TONS
FRESH TOMATOES	11,536.0	587.16	TONS
PROCESSING TOMATOES	93,670.0	62.06	TONS
ALMONDS	275,556.0	1,868.49	TONS
FRESH APPLES	1,264.0	329.06	TONS
PROCESSING APPLES	1,703.0	248.99	TONS
APRICOTS	12,743.0	231.72	TONS
AVOCADOS	1,018.0	1,238.91	TONS
FIGS	13,346.0	327.20	TONS
GRAPEFRUIT	964.0	320.82	TONS
TABLE GRAPES	71,975.0	326.64	TONS
RAISIN GRAPES	283,828.0	300.57	TONS
WINE GRAPES	215,288.0	330.14	TONS
FRESH LEMONS	2,450.0	303.56	TONS
PROCESSING LEMONS	5,415.0	60.76	TONS
NECTARINES	15,040.0	428.33	TONS
OLIVES	26,762.0	566.51	TONS
FRESH ORANGES	93,782.0	218.26	TONS
PROCESSING ORANGES	41,098.0	55.94	TONS
PEACHES	49,557.0	213.43	TONS
PISTACHIOS	27,262.0	1,901.64	TONS
PLUMS	26,530.0	575.67	TONS
PRUNES	5,878.0	643.39	TONS
WALNUTS	74,723.0	1,703.35	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)

1990

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	19,940.0	473,482.0
207	2,951.0	7,226.0
208	57,940.0	459,252.0
209	91,901.4	83,676.0
210	115,300.0	416,526.0
211	21,985.7	0.0
212	192,000.0	144,002.0
213	283,500.0	276,502.0
214	164,068.2	30,345.0
215	309,300.0	157,478.0
216	0.0	962,504.0
233	119,100.0	391,253.0
234	10,384.6	9,849.0
235	381,800.0	94,074.0
236	170,400.0	351,763.0
237	200,100.0	321,690.0
238	245,900.0	211,918.0
239	106,100.0	192,120.0
240	96,150.0	18,778.8
241	180,000.0	464,149.0
242	500,200.0	763,636.0
243	370,800.0	490,454.0
244	256,300.0	1,038,283.0
245	68,030.0	14,743.4
246	6,489.0	68,912.0
254	153,600.0	492,312.0
255	273,100.0	387,397.0
256	240,675.8	358,217.0
257	5,196.9	64,279.0
258	0.0	237,903.0
259	0.0	359,173.0
260	0.0	4,000.0
261	23,150.0	182,788.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,579.0	0.0	0.0	12,381.0	1,210.0	0.0
207	1,696.0	14,899.0	0.0	0.0	0.0	0.0
208	3,607.0	0.0	0.0	0.0	0.0	357.0
209	3,314.0	29,417.0	0.0	0.0	0.0	0.0
210	0.0	13,089.0	0.0	12,628.0	0.0	0.0
211	2,372.0	8,082.0	0.0	0.0	0.0	0.0
212	5,195.0	0.0	0.0	2,740.0	1,565.0	9,095.0
213	0.0	0.0	0.0	203.9	0.0	544.0
214	10,521.0	19,165.0	0.0	0.0	0.0	0.0
215	1,151.6	7,797.0	6,243.0	742.0	0.0	7,131.0
216	7,312.0	0.0	0.0	4,202.0	1,767.0	16,286.0
233	0.0	3,900.0	0.0	253.0	0.0	0.0
234	1,438.0	1,725.0	0.0	0.0	0.0	0.0
235	0.0	9,249.0	0.0	0.0	0.0	1,056.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	2,385.0	27,137.0	0.0	0.0	0.0	1,590.0
238	0.0	16,608.0	0.0	545.0	0.0	310.0
239	2,563.0	9,586.0	0.0	0.0	1,733.0	537.0
240	1,063.0	479.0	0.0	0.0	0.0	0.0
241	0.0	55,639.0	0.0	290.0	0.0	3,926.0
242	7,105.0	43,397.0	0.0	905.0	0.0	1,097.0
243	13,899.0	38,343.0	0.0	3,170.0	893.1	675.0
244	0.0	0.0	0.0	0.0	0.0	4,150.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	2,740.0	16,033.0	0.0	0.0	0.0	0.0
254	0.0	0.0	0.0	680.2	0.0	904.0
255	0.0	15,453.0	0.0	0.0	0.0	1,809.0
256	81.6	0.0	0.0	0.0	0.0	362.0
257	2,434.0	23,964.0	0.0	0.0	0.0	0.0
258	0.0	2,741.4	0.0	0.0	0.0	574.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	746.2
261	0.0	0.0	0.0	0.0	0.0	609.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	9,750.7	0.0	23,441.0	0.0	3,040.0
207	0.0	0.0	0.0	329.0	0.0	0.0
208	0.0	3,514.7	0.0	39,558.0	4,096.0	16,860.0
209	0.0	0.0	0.0	2,941.0	3,182.0	790.0
210	0.0	0.0	36,813.0	0.0	1,562.0	6,740.0
211	0.0	0.0	0.0	0.0	0.0	180.0
212	476.0	13,818.4	0.0	14,575.0	1,724.0	14,390.0
213	0.0	0.0	61,159.0	0.0	1,448.0	17,295.0
214	0.0	0.0	3,343.0	0.0	976.0	500.0
215	0.0	0.0	39,678.0	4,531.0	2,158.0	27,205.0
216	476.0	0.0	76,668.0	27,150.0	27,920.0	35,500.0
233	0.0	2,381.2	30,117.0	4,222.0	886.0	8,713.0
234	0.0	0.0	0.0	670.0	0.0	0.0
235	0.0	0.0	48,163.0	6,147.0	2,039.0	28,885.0
236	0.0	0.0	0.0	0.0	546.0	0.0
237	1,327.0	0.0	65,742.0	6,837.0	995.0	30,281.0
238	3,700.0	0.0	78,462.0	0.0	0.0	18,394.0
239	0.0	0.0	15,556.0	1,177.1	668.0	6,547.0
240	0.0	0.0	0.0	0.0	0.0	149.0
241	22,500.0	0.0	118,372.9	0.0	0.0	1,874.0
242	0.0	0.0	125,106.0	0.0	4,540.0	39,629.0
243	0.0	0.0	110,813.0	0.0	12,745.0	24,513.0
244	0.0	0.0	257,883.4	0.0	4,317.0	24,649.0
245	0.0	0.0	15,510.0	0.0	0.0	2,712.1
246	0.0	0.0	3,832.0	0.0	1,815.0	470.0
254	0.0	0.0	129,480.0	0.0	0.0	31,698.0
255	0.0	0.0	102,016.0	0.0	0.0	30,430.0
256	0.0	0.0	69,724.0	0.0	0.0	15,684.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	26,086.0	0.0	0.0	3,250.0
259	0.0	0.0	54,416.5	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	41,011.8	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1990

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	1,012.0	0.0	337.0	416.0	337.0	13,191.0
233	543.0	0.0	217.0	272.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	326.0	0.0	163.0	163.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	543.0	1,141.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	978.0	0.0	217.0	326.0	1,195.0	978.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	1,070.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	3,834.0	0.0	0.0	2,390.0	0.0
259	0.0	3,530.0	0.0	0.0	684.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	3,834.0	0.0	0.0	543.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1990

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,799.0	0.0	0.0	0.0	562.0
211	0.0	0.0	0.0	0.0	0.0	281.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	3,037.0	7,310.0	2,699.0	1,125.0	3,036.0	0.0
233	652.0	1,798.0	869.0	0.0	0.0	272.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,303.0	0.0	0.0	0.0	272.0
236	433.0	0.0	1,086.0	0.0	0.0	212.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,677.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	2,015.0	0.0	0.0	0.0	489.0
244	3,204.0	9,531.0	543.0	543.0	1,303.0	272.0
245	543.0	2,716.0	543.0	0.0	0.0	217.0
246	342.0	0.0	0.0	163.0	163.0	0.0
254	527.0	0.0	869.0	0.0	0.0	0.0
255	0.0	0.0	3,259.0	0.0	0.0	0.0
256	0.0	0.0	2,661.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	543.0	2,716.0	0.0	0.0	0.0	0.0
259	4,073.0	2,411.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	4,921.0	5,007.0	4,236.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,316.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	7,456.0	0.0	756.0	6,160.0
211	0.0	0.0	0.0	0.0	517.0	0.0
212	0.0	0.0	0.0	0.0	4,015.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	2,708.0
215	0.0	0.0	0.0	0.0	0.0	7,239.0
216	0.0	0.0	0.0	1,125.0	2,654.0	21,841.0
233	0.0	0.0	0.0	0.0	230.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	589.0	0.0
236	0.0	0.0	326.0	532.9	150.0	2,800.0
237	0.0	0.0	0.0	0.0	481.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	163.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	109.0	1,396.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	978.0	1,981.0	37,022.0
245	0.0	0.0	0.0	0.0	0.0	1,296.0
246	0.0	0.0	0.0	0.0	0.0	1,391.0
254	109.0	1,988.0	0.0	0.0	0.0	1,762.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	174.0	3,291.0	0.0	0.0	0.0	2,894.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	815.0	19,661.0	0.0	0.0	0.0	3,901.0
259	0.0	0.0	0.0	0.0	0.0	1,762.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	272.0	717.0	0.0	0.0	0.0	2,894.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	20,343.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,987.0	0.0	0.0	0.0	0.0	0.0	0.0
208	41,825.0	0.0	0.0	0.0	0.0	0.0	0.0
209	21,927.0	632.0	1,264.0	0.0	0.0	0.0	0.0
210	31,431.0	0.0	0.0	0.0	0.0	1,013.0	0.0
211	2,168.0	0.0	0.0	0.0	0.0	0.0	0.0
212	6,031.0	0.0	0.0	0.0	0.0	0.0	0.0
213	20,447.0	0.0	0.0	0.0	0.0	948.0	0.0
214	8,115.0	0.0	0.0	0.0	0.0	3,737.0	0.0
215	2,147.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,880.0	0.0	0.0	9,913.0	0.0	0.0	0.0
233	8,985.0	0.0	0.0	0.0	0.0	4,766.0	0.0
234	1,053.0	0.0	0.0	0.0	0.0	793.0	0.0
235	4,113.0	0.0	0.0	0.0	0.0	0.0	0.0
236	3,937.0	0.0	0.0	0.0	0.0	0.0	0.0
237	1,917.0	0.0	0.0	0.0	0.0	0.0	0.0
238	175.0	0.0	0.0	0.0	0.0	0.0	0.0
239	943.0	0.0	0.0	0.0	0.0	0.0	0.0
240	440.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	1,018.0	0.0	0.0
243	7,165.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,437.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,510.0	0.0	0.0	2,830.0	0.0	0.0	0.0
254	1,800.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,410.0	0.0	0.0	0.0	0.0	0.0	0.0
256	29,700.0	632.0	439.0	0.0	0.0	1,393.0	0.0
257	11,090.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,100.0	0.0	0.0	0.0	0.0	696.0	0.0
259	16,300.0	0.0	0.0	0.0	0.0	0.0	0.0
260	500.0	0.0	0.0	0.0	0.0	0.0	0.0
261	680.0	0.0	0.0	0.0	0.0	0.0	964.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1990

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,692.0	0.0	11,573.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,668.0	0.0	13,026.0	0.0	0.0	0.0	0.0
209	2,516.0	0.0	10,064.0	0.0	0.0	0.0	0.0
210	10,057.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	4,247.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	38,948.0	11,573.0	0.0	0.0	0.0	550.0
214	0.0	4,888.0	23,146.0	0.0	0.0	0.0	1,200.0
215	0.0	5,340.0	16,607.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	49,028.0	0.0	182.0	186.0	2,883.0	2,786.0
234	0.0	1,076.0	0.0	0.0	0.0	0.0	0.0
235	0.0	19,097.0	0.0	0.0	0.0	0.0	0.0
236	0.0	113,694.0	0.0	0.0	0.0	6,144.0	0.0
237	0.0	6,841.0	0.0	0.0	0.0	0.0	0.0
238	229.0	1,375.0	868.0	0.0	0.0	300.0	0.0
239	4,983.0	6,549.0	12,486.0	0.0	0.0	3,357.0	1,607.0
240	4,983.0	1,146.0	6,401.0	214.0	325.0	409.0	5,143.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	3,630.0	16,925.0	59,384.0	429.0	762.0	1,411.0	8,426.0
243	17,297.0	0.0	0.0	429.0	797.0	0.0	1,698.0
244	6,646.0	0.0	0.0	0.0	0.0	0.0	638.0
245	0.0	0.0	1,012.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	857.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	223.0	18,921.0	861.0	0.0	0.0	0.0	0.0
256	5,855.0	0.0	24,647.0	214.0	656.0	536.0	964.0
257	535.0	0.0	0.0	429.0	969.0	0.0	0.0
258	4,742.0	0.0	0.0	214.0	503.0	0.0	0.0
259	1,140.0	0.0	23,640.0	0.0	0.0	0.0	2,893.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	532.0	0.0	0.0	339.0	1,217.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1990

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	6,438.0	0.0	0.0	0.0	13,748.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	7,876.0	0.0	0.0	0.0	5,992.0
209	0.0	0.0	2,397.0	0.0	0.0	0.0	675.0
210	0.0	0.0	8,955.0	0.0	0.0	0.0	545.0
211	0.0	0.0	0.0	2,397.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,397.0	0.0	0.0	0.0
213	0.0	0.0	2,299.0	0.0	931.0	0.0	964.0
214	2,850.0	100.0	479.0	5,628.0	0.0	0.0	670.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,492.0	0.0	0.0	0.0	7,517.0
233	2,548.0	912.0	1,816.0	775.0	2,143.0	1,072.0	2,883.0
234	1,452.0	673.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,824.0	0.0	0.0	0.0	0.0
236	377.0	225.0	4,537.0	775.0	2,893.0	0.0	6,498.0
237	0.0	0.0	0.0	0.0	0.0	0.0	836.0
238	0.0	0.0	643.0	0.0	1,072.0	0.0	4,586.0
239	4,109.0	1,619.0	5,139.0	0.0	8,583.0	0.0	0.0
240	11,329.0	4,751.0	778.0	0.0	860.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	37,702.0	15,998.0	1,072.0	0.0	5,143.0	3,302.0	21,398.0
243	14,039.0	6,004.0	0.0	2,745.0	2,847.0	1,504.0	7,736.0
244	0.0	0.0	0.0	1,111.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	402.0	279.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	6,965.0	4,072.0	980.0	3,216.0	1,072.0	0.0	461.0
257	6,624.0	3,603.0	0.0	0.0	0.0	0.0	0.0
258	3,300.0	1,950.0	964.0	4,058.0	986.0	0.0	214.0
259	1,050.0	468.0	0.0	4,160.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	1,035.0	444.0	868.0	0.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 2, 1995

TABLE 6.4.4

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,138,165.5
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,074,079.5
TOTAL GROUND WATER USED (AC-FT)	7,211,453.0
TOTAL SURFACE WATER USED (AC-FT)	7,058,034.0
CONSUMER SURPLUS	$ 877,587,712.00
NET FARM INCOME	$2,970,284,032.00

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	62,786.3	5.54	CWTS
BARLEY	340,666.1	5.44	CWTS
OATS	6,243.0	5.05	CWTS
RICE	42,277.0	10.71	CWTS
SORGHUM	5,145.2	4.57	CWTS
SUGAR BEETS	50,016.0	45.05	TONS
SAFFLOWER	28,455.0	231.88	TONS
IRRIGATED PASTURE	26,599.0	132.27	ACRES
COTTON	1,492,148.8	326.81	BALES
CORN	132,065.8	5.44	CWTS
DRY BEANS	69,995.0	31.78	CWTS
ALFALFA	380,198.9	83.06	TONS
SNAPBEANS	3,052.0	657.25	TONS
CARROTS	13,214.0	14.39	CWTS
FALL CAULIFLOWER	1,582.0	36.61	CWTS
OTHER CAULIFLOWER	2,483.0	39.16	CWTS
GARLIC	5,537.0	368.12	TONS
LIMA BEANS	14,904.0	410.95	TONS
LETTUCE	19,601.0	269.32	TONS
CANTALOUPS	42,060.0	329.22	TONS
ONIONS	17,984.0	175.20	TONS
FRESH PEAS	1,941.0	633.52	TONS
PROCESSING PEAS	4,767.0	242.09	TONS
BELL PEPPERS	2,749.0	26.67	CWTS
WINTER POTATOES	1,590.0	8.78	CWTS
SPRING POTATOES	29,135.0	7.93	CWTS
SWEET POTATOES	9,211.0	377.36	TONS
SPINACH	2,234.0	81.77	TONS
FRESH TOMATOES	12,208.0	642.47	TONS
PROCESSING TOMATOES	101,476.0	58.68	TONS
ALMONDS	278,451.3	2,026.70	TONS
FRESH APPLES	1,304.0	348.01	TONS
PROCESSING APPLES	1,757.0	267.91	TONS
APRICOTS	13,156.0	230.87	TONS
AVOCADOS	1,048.0	1,449.85	TONS
FIGS	13,764.0	323.12	TONS
GRAPEFRUIT	993.0	355.22	TONS
TABLE GRAPES	75,575.0	329.18	TONS
RAISIN GRAPES	298,018.0	318.49	TONS
WINE GRAPES	226,054.0	361.78	TONS
FRESH LEMONS	2,523.0	325.44	TONS
PROCESSING LEMONS	5,577.0	71.12	TONS
NECTARINES	15,493.0	461.80	TONS
OLIVES	28,389.0	630.84	TONS
FRESH ORANGES	97,547.0	216.99	TONS
PROCESSING ORANGES	42,147.0	59.18	TONS
PEACHES	51,134.0	227.56	TONS
PISTACHIOS	27,313.0	2,068.16	TONS
PLUMS	27,328.0	626.17	TONS
PRUNES	6,055.0	659.55	TONS
WALNUTS	77,057.0	1,832.27	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
1995

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	30,900.0	465,952.0
207	3,049.6	7,233.0
208	64,760.0	448,665.0
209	95,253.7	83,681.0
210	142,200.0	411,742.0
211	23,237.8	0.0
212	213,900.0	135,521.0
213	483,700.0	111,713.0
214	164,493.4	30,332.0
215	317,900.0	149,226.0
216	24,840.4	952,504.0
233	222,100.0	294,554.0
234	10,907.7	9,877.0
235	386,800.0	93,096.0
236	363,700.0	181,320.0
237	354,400.0	169,028.0
238	328,800.0	136,110.0
239	218,000.0	86,769.0
240	99,490.0	19,743.0
241	367,500.0	292,882.0
242	928,400.0	333,441.0
243	573,000.0	315,871.0
244	291,600.0	1,042,047.0
245	67,260.0	14,284.0
246	20,590.0	37,464.7
254	355,200.0	286,312.0
255	419,500.0	229,710.0
256	409,740.1	205,935.0
257	8,866.0	63,204.5
258	22,590.0	209,886.0
259	0.0	215,680.0
260	0.0	4,000.0
261	49,550.0	169,479.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,579.0	0.0	0.0	13,928.0	1,210.0	0.0
207	1,696.0	14,899.0	0.0	0.0	0.0	0.0
208	3,607.0	0.0	0.0	0.0	0.0	386.0
209	3,314.0	29,417.0	0.0	0.0	0.0	0.0
210	0.0	9,327.9	0.0	14,206.0	0.0	0.0
211	2,372.0	8,082.0	0.0	0.0	0.0	0.0
212	5,195.0	0.0	0.0	3,082.0	1,565.0	9,823.0
213	0.0	0.0	0.0	336.0	0.0	588.0
214	10,521.0	19,165.0	0.0	0.0	0.0	0.0
215	0.0	7,797.0	6,243.0	834.0	0.0	7,702.0
216	3,542.3	0.0	0.0	4,728.0	0.0	17,589.0
233	0.0	3,783.0	0.0	253.0	0.0	0.0
234	1,395.0	1,674.0	0.0	0.0	0.0	0.0
235	0.0	8,972.0	0.0	0.0	0.0	792.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	2,313.0	26,323.0	0.0	0.0	0.0	1,193.0
238	0.0	16,110.0	0.0	545.0	0.0	233.0
239	2,486.0	9,298.0	0.0	0.0	1,681.0	403.0
240	1,031.0	465.0	0.0	0.0	0.0	0.0
241	0.0	53,970.0	0.0	290.0	0.0	2,945.0
242	6,892.0	42,096.0	0.0	905.0	0.0	823.0
243	13,482.0	37,193.0	0.0	3,170.0	689.2	506.0
244	0.0	0.0	0.0	0.0	0.0	3,113.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	15,552.0	0.0	0.0	0.0	0.0
254	0.0	0.0	0.0	0.0	0.0	678.0
255	0.0	13,297.2	0.0	0.0	0.0	1,356.0
256	0.0	0.0	0.0	0.0	0.0	271.0
257	2,361.0	23,245.0	0.0	0.0	0.0	0.0
258	0.0	0.0	0.0	0.0	0.0	431.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	728.0
261	0.0	0.0	0.0	0.0	0.0	456.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
1995

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	10,710.1	0.0	24,496.0	0.0	3,040.0
207	0.0	0.0	0.0	343.0	0.0	0.0
208	0.0	1,013.8	0.0	41,338.0	3,994.0	16,860.0
209	0.0	0.0	0.0	3,074.0	3,102.0	790.0
210	0.0	0.0	39,390.0	0.0	1,523.0	6,740.0
211	0.0	0.0	0.0	0.0	0.0	180.0
212	464.0	14,321.4	0.0	15,231.0	1,681.0	14,390.0
213	0.0	0.0	57,685.8	0.0	1,412.0	17,295.0
214	0.0	0.0	0.0	0.0	952.0	500.0
215	0.0	0.0	42,455.0	0.0	2,104.0	27,205.0
216	464.0	0.0	82,034.0	28,372.0	27,222.0	35,500.0
233	0.0	553.8	30,719.0	4,222.0	886.0	8,425.0
234	0.0	0.0	0.0	670.0	0.0	0.0
235	0.0	0.0	49,127.0	6,147.0	2,039.0	27,932.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	1,327.0	0.0	67,057.0	7,250.4	995.0	29,282.0
238	3,700.0	0.0	80,031.0	0.0	0.0	17,787.0
239	0.0	0.0	15,867.0	922.4	668.0	6,331.0
240	0.0	0.0	0.0	0.0	0.0	144.0
241	22,500.0	0.0	123,942.6	0.0	0.0	1,812.0
242	0.0	0.0	124,508.4	0.0	4,540.0	38,321.0
243	0.0	0.0	113,029.0	0.0	12,745.0	23,704.0
244	0.0	0.0	265,451.9	0.0	4,317.0	23,836.0
245	0.0	0.0	13,796.1	0.0	0.0	3,689.0
246	0.0	0.0	0.0	0.0	1,815.0	454.0
254	0.0	0.0	132,070.0	0.0	0.0	30,652.0
255	0.0	0.0	104,056.0	0.0	0.0	29,426.0
256	0.0	0.0	71,118.0	0.0	0.0	15,167.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	26,607.0	0.0	0.0	736.9
259	0.0	0.0	9,475.6	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	43,728.8	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	1,063.0	0.0	354.0	437.0	354.0	13,851.0
233	585.0	0.0	234.0	292.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	351.0	0.0	175.0	175.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	585.0	1,228.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	1,053.0	0.0	234.0	351.0	1,287.0	1,053.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	1,152.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	4,130.0	0.0	0.0	2,574.0	0.0
259	0.0	3,802.0	0.0	0.0	737.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	4,130.0	0.0	0.0	585.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,889.0	0.0	0.0	0.0	590.0
211	0.0	0.0	0.0	0.0	0.0	295.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	3,189.0	7,675.0	2,834.0	1,181.0	3,188.0	0.0
233	702.0	1,936.0	936.0	0.0	0.0	292.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,480.0	0.0	0.0	0.0	292.0
236	467.0	0.0	1,170.0	0.0	0.0	228.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,806.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	2,170.0	0.0	0.0	0.0	526.0
244	3,451.0	10,264.0	585.0	585.0	1,404.0	292.0
245	585.0	2,925.0	585.0	0.0	0.0	234.0
246	369.0	0.0	0.0	175.0	175.0	0.0
254	567.0	0.0	936.0	0.0	0.0	0.0
255	0.0	0.0	3,510.0	0.0	0.0	0.0
256	0.0	0.0	2,866.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	585.0	2,925.0	0.0	0.0	0.0	0.0
259	4,387.0	2,597.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	5,299.0	5,393.0	4,562.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,382.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	7,829.0	0.0	793.0	7,023.0
211	0.0	0.0	0.0	0.0	543.0	0.0
212	0.0	0.0	0.0	0.0	4,215.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	3,087.0
215	0.0	0.0	0.0	0.0	0.0	8,252.0
216	0.0	0.0	0.0	1,181.0	2,787.0	24,899.0
233	0.0	0.0	0.0	0.0	248.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	634.0	0.0
236	0.0	0.0	0.0	0.0	161.0	0.0
237	0.0	0.0	0.0	0.0	518.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	175.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	117.0	1,503.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	1,053.0	2,134.0	40,724.0
245	0.0	0.0	0.0	0.0	0.0	1,426.0
246	0.0	0.0	0.0	0.0	0.0	1,530.0
254	117.0	2,141.0	0.0	0.0	0.0	1,938.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	187.0	3,545.0	0.0	0.0	0.0	3,184.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	877.0	21,174.0	0.0	0.0	0.0	4,291.0
259	0.0	0.0	0.0	0.0	0.0	1,938.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	292.0	772.0	0.0	0.0	0.0	3,184.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	20,343.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,987.0	0.0	0.0	0.0	0.0	0.0	0.0
208	41,825.0	0.0	0.0	0.0	0.0	0.0	0.0
209	21,927.0	653.0	1,305.0	0.0	0.0	0.0	0.0
210	31,431.0	0.0	0.0	0.0	0.0	1,047.0	0.0
211	2,168.0	0.0	0.0	0.0	0.0	0.0	0.0
212	6,031.0	0.0	0.0	0.0	0.0	0.0	0.0
213	20,447.0	0.0	0.0	0.0	0.0	979.0	0.0
214	8,115.0	0.0	0.0	0.0	0.0	3,860.0	0.0
215	2,147.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,880.0	0.0	0.0	10,241.0	0.0	0.0	0.0
233	9,344.0	0.0	0.0	0.0	0.0	4,909.0	0.0
234	1,095.0	0.0	0.0	0.0	0.0	817.0	0.0
235	4,278.0	0.0	0.0	0.0	0.0	0.0	0.0
236	2,659.3	0.0	0.0	0.0	0.0	0.0	0.0
237	1,994.0	0.0	0.0	0.0	0.0	0.0	0.0
238	182.0	0.0	0.0	0.0	0.0	0.0	0.0
239	981.0	0.0	0.0	0.0	0.0	0.0	0.0
240	458.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	1,048.0	0.0	0.0
243	7,452.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,654.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,650.0	0.0	0.0	2,915.0	0.0	0.0	0.0
254	1,872.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,586.0	0.0	0.0	0.0	0.0	0.0	0.0
256	30,888.0	651.0	452.0	0.0	0.0	1,435.0	0.0
257	11,534.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,344.0	0.0	0.0	0.0	0.0	717.0	0.0
259	16,952.0	0.0	0.0	0.0	0.0	0.0	0.0
260	520.0	0.0	0.0	0.0	0.0	0.0	0.0
261	707.0	0.0	0.0	0.0	0.0	0.0	993.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,777.0	0.0	12,152.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,801.0	0.0	13,677.0	0.0	0.0	0.0	0.0
209	2,642.0	0.0	10,567.0	0.0	0.0	0.0	0.0
210	10,560.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	4,460.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	40,895.0	12,152.0	0.0	0.0	0.0	825.0
214	0.0	5,133.0	24,303.0	0.0	0.0	0.0	1,800.0
215	0.0	5,607.0	17,438.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	51,479.0	0.0	188.0	192.0	2,970.0	2,870.0
234	0.0	1,130.0	0.0	0.0	0.0	0.0	0.0
235	0.0	20,052.0	0.0	0.0	0.0	0.0	0.0
236	0.0	119,378.0	0.0	0.0	0.0	6,328.0	0.0
237	0.0	7,183.0	0.0	0.0	0.0	0.0	0.0
238	241.0	1,444.0	911.0	0.0	0.0	309.0	0.0
239	5,232.0	6,876.0	13,111.0	0.0	0.0	3,458.0	1,655.0
240	5,232.0	1,203.0	6,721.0	221.0	334.0	422.0	5,298.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	3,811.0	17,771.0	62,353.0	441.0	785.0	1,454.0	8,679.0
243	18,161.0	0.0	0.0	441.0	821.0	0.0	1,749.0
244	6,978.0	0.0	0.0	0.0	0.0	0.0	657.0
245	0.0	0.0	1,063.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	883.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	235.0	19,867.0	904.0	0.0	0.0	0.0	0.0
256	6,148.0	0.0	25,880.0	221.0	675.0	552.0	993.0
257	562.0	0.0	0.0	441.0	998.0	0.0	0.0
258	4,980.0	0.0	0.0	221.0	518.0	0.0	0.0
259	1,197.0	0.0	24,822.0	0.0	0.0	0.0	2,980.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	558.0	0.0	0.0	349.0	1,254.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

1995

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	6,651.0	0.0	0.0	0.0	14,202.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	8,136.0	0.0	0.0	0.0	6,189.0
209	0.0	0.0	2,476.0	0.0	0.0	0.0	698.0
210	0.0	0.0	9,250.0	0.0	0.0	0.0	563.0
211	0.0	0.0	0.0	2,476.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,476.0	0.0	0.0	0.0
213	0.0	0.0	2,374.0	0.0	962.0	0.0	996.0
214	4,275.0	150.0	495.0	5,814.0	0.0	0.0	692.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,542.0	0.0	0.0	0.0	7,765.0
233	2,624.0	939.0	1,871.0	798.0	2,207.0	1,104.0	2,970.0
234	1,495.0	693.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,909.0	0.0	0.0	0.0	0.0
236	0.0	0.0	4,673.0	0.0	2,980.0	0.0	6,693.0
237	0.0	0.0	0.0	0.0	0.0	0.0	861.0
238	0.0	0.0	662.0	0.0	1,104.0	0.0	4,724.0
239	4,233.0	1,668.0	5,293.0	0.0	8,840.0	0.0	0.0
240	11,669.0	4,894.0	801.0	0.0	886.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	38,833.0	16,478.0	1,104.0	0.0	5,298.0	3,401.0	22,040.0
243	14,460.0	6,184.0	0.0	2,827.0	2,932.0	1,550.0	7,968.0
244	0.0	0.0	0.0	1,145.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	414.0	287.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	7,174.0	4,194.0	1,010.0	3,313.0	1,104.0	0.0	475.0
257	6,823.0	3,712.0	0.0	0.0	0.0	0.0	0.0
258	3,399.0	2,009.0	993.0	4,180.0	1,015.0	0.0	221.0
259	1,082.0	482.0	0.0	4,284.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	1,066.0	457.0	894.0	0.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
SCENARIO 2, 2000

TABLE 6.4.5

TOTAL IRRIGATED PRIME LAND USED (ACRES)	3,099,661.0
TOTAL IRRIGATED NONPRIME LAND USED (ACRES)	1,104,037.0
TOTAL GROUND WATER USED (AC-FT)	10,164,332.0
TOTAL SURFACE WATER USED (AC-FT)	4,000,117.5
CONSUMER SURPLUS	$ 919,302,272.00
NET FARM INCOME	$3,328,780,800.00

CROPS PRODUCED

CROP	ACRES	PRICE	UNITS
WHEAT	58,346.0	5.54	CWTS
BARLEY	324,028.8	5.57	CWTS
OATS	0.0	5.09	CWTS
RICE	48,568.0	11.57	CWTS
SORGHUM	3,698.4	4.57	CWTS
SUGAR BEETS	49,578.9	45.05	TONS
SAFFLOWER	28,433.0	231.89	TONS
IRRIGATED PASTURE	21,247.0	137.67	ACRES
COTTON	1,492,940.8	326.84	BALES
CORN	127,649.2	5.46	CWTS
DRY BEANS	68,944.0	34.23	CWTS
ALFALFA	374,776.0	88.26	TONS
SNAPBEANS	3,258.0	676.99	TONS
CARROTS	14,232.0	15.54	CWTS
FALL CAULIFLOWER	1,695.0	40.37	CWTS
OTHER CAULIFLOWER	2,664.0	42.91	CWTS
GARLIC	5,160.0	376.27	TONS
LIMA BEANS	15,677.0	452.31	TONS
LETTUCE	16,301.0	292.74	TONS
CANTALOUPS	45,041.0	360.70	TONS
ONIONS	19,293.0	190.51	TONS
FRESH PEAS	2,059.0	654.81	TONS
PROCESSING PEAS	5,049.0	262.07	TONS
BELL PEPPERS	2,940.0	27.62	CWTS
WINTER POTATOES	1,714.0	8.96	CWTS
SPRING POTATOES	31,380.0	8.08	CWTS
SWEET POTATOES	9,671.0	392.40	TONS
SPINACH	2,374.0	87.06	TONS
FRESH TOMATOES	12,924.0	703.67	TONS
PROCESSING TOMATOES	111,221.0	58.08	TONS
ALMONDS	262,502.0	2,261.59	TONS
FRESH APPLES	1,345.0	369.16	TONS
PROCESSING APPLES	1,814.0	288.79	TONS
APRICOTS	13,581.0	229.99	TONS
AVOCADOS	1,080.0	1,682.72	TONS
FIGS	14,193.0	318.93	TONS
GRAPEFRUIT	1,023.0	393.20	TONS
TABLE GRAPES	78,096.0	347.67	TONS
RAISIN GRAPES	312,919.0	338.52	TONS
WINE GRAPES	235,192.5	397.96	TONS
FRESH LEMONS	2,598.0	349.66	TONS
PROCESSING LEMONS	5,744.0	82.58	TONS
NECTARINES	15,955.0	499.19	TONS
OLIVES	27,405.0	749.51	TONS
FRESH ORANGES	101,367.0	216.55	TONS
PROCESSING ORANGES	42,984.0	66.08	TONS
PEACHES	52,762.0	243.28	TONS
PISTACHIOS	23,753.0	2,263.53	TONS
PLUMS	28,151.0	682.68	TONS
PRUNES	6,237.0	677.59	TONS
WALNUTS	75,475.3	1,992.19	TONS

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)

2000

DAU	GROUND WATER (ACRE-FEET)	SURFACE WATER (ACRE-FEET)
206	276,900.0	231,350.0
207	5,452.9	4,894.0
208	332,900.0	182,012.0
209	143,675.0	38,560.0
210	407,000.0	160,741.0
211	26,565.1	0.0
212	297,300.0	46,705.0
213	572,400.0	23,059.0
214	191,446.4	21,852.0
215	367,400.0	105,018.0
216	249,930.3	743,417.0
233	346,100.0	175,370.0
234	17,860.0	7,419.0
235	426,900.0	60,021.0
236	420,800.0	111,140.0
237	417,400.0	107,830.0
238	376,900.0	89,455.0
239	283,200.0	24,349.0
240	105,000.0	18,703.2
241	495,300.0	213,460.0
242	1,053,000.0	169,995.0
243	730,300.0	133,818.0
244	792,400.0	590,406.0
245	20,207.1	10,685.0
246	26,920.0	31,825.3
254	467,200.0	146,404.0
255	462,600.0	175,812.0
256	553,000.0	52,451.0
257	19,060.0	55,694.6
258	109,100.0	127,771.0
259	0.0	82,078.0
260	0.0	4,000.0
261	65,100.0	158,841.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
2000

DAU	WHEAT	BARLEY	OATS	RICE	SORGHUM	SUGARBEETS
206	2,579.0	0.0	0.0	15,669.0	1,210.0	0.0
207	1,696.0	14,899.0	0.0	0.0	0.0	0.0
208	3,607.0	0.0	0.0	0.0	0.0	416.0
209	3,314.0	29,417.0	0.0	0.0	0.0	0.0
210	0.0	2,276.2	0.0	15,982.0	0.0	0.0
211	2,372.0	8,082.0	0.0	0.0	0.0	0.0
212	5,195.0	0.0	0.0	3,468.0	1,565.0	10,608.0
213	0.0	0.0	0.0	378.0	0.0	635.0
214	10,521.0	19,165.0	0.0	0.0	0.0	0.0
215	0.0	7,797.0	0.0	939.0	0.0	8,318.0
216	0.0	0.0	0.0	5,319.0	0.0	18,996.0
233	0.0	3,670.0	0.0	253.0	0.0	0.0
234	1,353.0	1,623.0	0.0	0.0	0.0	0.0
235	0.0	8,703.0	0.0	0.0	0.0	594.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	2,244.0	25,533.0	0.0	0.0	0.0	895.0
238	0.0	15,627.0	0.0	545.0	0.0	174.0
239	2,412.0	9,019.0	0.0	0.0	923.4	302.0
240	1,000.0	451.0	0.0	0.0	0.0	0.0
241	0.0	52,351.0	0.0	290.0	0.0	2,208.0
242	6,685.0	40,833.0	0.0	905.0	0.0	617.0
243	13,078.0	36,077.0	0.0	3,170.0	0.0	379.0
244	0.0	0.0	0.0	0.0	0.0	2,334.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	15,086.0	0.0	0.0	0.0	0.0
254	0.0	0.0	0.0	1,650.0	0.0	509.0
255	0.0	10,871.6	0.0	0.0	0.0	1,017.0
256	0.0	0.0	0.0	0.0	0.0	203.0
257	2,290.0	22,548.0	0.0	0.0	0.0	0.0
258	0.0	0.0	0.0	0.0	0.0	323.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	708.9
261	0.0	0.0	0.0	0.0	0.0	342.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	SAFFLOWER	IRR.PAST.	COTTON	CORN	DRY BEANS	ALFALFA
206	0.0	8,714.4	0.0	25,599.0	0.0	3,040.0
207	0.0	0.0	0.0	359.0	0.0	0.0
208	0.0	0.0	0.0	43,198.0	3,894.0	16,860.0
209	0.0	0.0	0.0	3,212.0	3,025.0	790.0
210	0.0	0.0	42,147.0	0.0	1,485.0	6,740.0
211	0.0	0.0	0.0	686.0	0.0	180.0
212	453.0	11,767.3	0.0	15,916.0	1,639.0	14,390.0
213	0.0	0.0	53,997.1	0.0	1,376.0	17,295.0
214	0.0	0.0	0.0	0.0	928.0	500.0
215	0.0	0.0	44,401.5	0.0	2,051.0	27,205.0
216	453.0	0.0	87,777.0	19,189.8	26,541.0	35,500.0
233	0.0	0.0	31,333.0	4,222.0	886.0	8,147.0
234	0.0	765.4	0.0	670.0	0.0	0.0
235	0.0	0.0	50,109.0	6,147.0	2,039.0	27,010.0
236	0.0	0.0	0.0	0.0	0.0	0.0
237	1,327.0	0.0	68,398.0	8,450.4	995.0	28,316.0
238	3,700.0	0.0	81,632.0	0.0	0.0	17,200.0
239	0.0	0.0	16,184.0	0.0	668.0	6,122.0
240	0.0	0.0	0.0	0.0	0.0	140.0
241	22,500.0	0.0	137,012.2	0.0	0.0	1,752.0
242	0.0	0.0	110,558.7	0.0	4,540.0	37,057.0
243	0.0	0.0	115,290.0	0.0	12,745.0	22,922.0
244	0.0	0.0	275,042.4	0.0	4,317.0	23,049.0
245	0.0	0.0	0.0	0.0	0.0	3,567.0
246	0.0	0.0	0.0	0.0	1,815.0	439.0
254	0.0	0.0	134,711.0	0.0	0.0	29,640.0
255	0.0	0.0	106,137.0	0.0	0.0	28,455.0
256	0.0	0.0	72,540.0	0.0	0.0	14,666.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	0.0	22,778.1	0.0	0.0	3,039.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	0.0	42,893.1	0.0	0.0	755.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	SNAPBEANS	CARROTS	FALL CAUL	OTHR CAUL	GARLIC	LIMABEANS
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	1,116.0	0.0	372.0	459.0	372.0	14,543.0
233	630.0	0.0	252.0	315.0	0.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	0.0	0.0
236	378.0	0.0	189.0	189.0	0.0	0.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	630.0	1,323.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	0.0	0.0	0.0	0.0	0.0
244	1,134.0	0.0	252.0	378.0	1,386.0	1,134.0
245	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0
254	0.0	1,241.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	0.0	0.0	0.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	0.0	4,448.0	0.0	0.0	2,772.0	0.0
259	0.0	4,095.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	0.0	4,448.0	0.0	0.0	630.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	LETTUCE	CANTALOUP	ONIONS	FRSH PEAS	PROC PEAS	BELL PEPP
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	0.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	1,984.0	0.0	0.0	0.0	620.0
211	0.0	0.0	0.0	0.0	0.0	310.0
212	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	0.0
215	0.0	0.0	0.0	0.0	0.0	0.0
216	3,349.0	8,059.0	2,976.0	1,240.0	3,348.0	0.0
233	756.0	2,085.0	1,008.0	0.0	0.0	315.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	2,671.0	0.0	0.0	0.0	315.0
236	503.0	0.0	1,260.0	0.0	0.0	246.0
237	0.0	0.0	0.0	0.0	0.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	1,945.0	0.0	0.0	0.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	0.0	2,337.0	0.0	0.0	0.0	567.0
244	3,717.0	11,055.0	630.0	630.0	1,512.0	315.0
245	630.0	3,150.0	630.0	0.0	0.0	252.0
246	397.0	0.0	0.0	189.0	189.0	0.0
254	611.0	0.0	1,008.0	0.0	0.0	0.0
255	0.0	0.0	3,780.0	0.0	0.0	0.0
256	0.0	0.0	3,087.0	0.0	0.0	0.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	630.0	3,150.0	0.0	0.0	0.0	0.0
259	0.0	2,797.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	5,708.0	5,808.0	4,914.0	0.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU
2000

DAU	WNTR POTS	SPRG POTS	SWEET POT	SPINACH	FRSH TOMA	PROC TOMA
206	0.0	0.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	1,451.0	0.0	0.0	0.0
209	0.0	0.0	0.0	0.0	0.0	0.0
210	0.0	0.0	8,220.0	0.0	833.0	8,006.0
211	0.0	0.0	0.0	0.0	570.0	0.0
212	0.0	0.0	0.0	0.0	4,426.0	0.0
213	0.0	0.0	0.0	0.0	0.0	0.0
214	0.0	0.0	0.0	0.0	0.0	3,520.0
215	0.0	0.0	0.0	0.0	0.0	9,407.0
216	0.0	0.0	0.0	1,240.0	2,926.0	28,384.0
233	0.0	0.0	0.0	0.0	267.0	0.0
234	0.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	0.0	0.0	683.0	0.0
236	0.0	0.0	0.0	0.0	174.0	0.0
237	0.0	0.0	0.0	0.0	558.0	0.0
238	0.0	0.0	0.0	0.0	0.0	0.0
239	0.0	0.0	0.0	0.0	189.0	0.0
240	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	0.0	0.0
243	126.0	1,619.0	0.0	0.0	0.0	0.0
244	0.0	0.0	0.0	1,134.0	2,298.0	44,797.0
245	0.0	0.0	0.0	0.0	0.0	1,568.0
246	0.0	0.0	0.0	0.0	0.0	1,683.0
254	126.0	2,306.0	0.0	0.0	0.0	2,132.0
255	0.0	0.0	0.0	0.0	0.0	0.0
256	202.0	3,818.0	0.0	0.0	0.0	3,502.0
257	0.0	0.0	0.0	0.0	0.0	0.0
258	945.0	22,805.0	0.0	0.0	0.0	4,720.0
259	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0
261	315.0	832.0	0.0	0.0	0.0	3,502.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	ALMONDS	FRSH APPL	PROC APPL	APRICOTS	AVOCADOS	FIGS	GRAPEFRT
206	20,343.0	0.0	0.0	0.0	0.0	0.0	0.0
207	1,987.0	0.0	0.0	0.0	0.0	0.0	0.0
208	41,825.0	0.0	0.0	0.0	0.0	0.0	0.0
209	21,927.0	674.0	1,348.0	0.0	0.0	0.0	0.0
210	31,431.0	0.0	0.0	0.0	0.0	1,081.0	0.0
211	2,168.0	0.0	0.0	0.0	0.0	0.0	0.0
212	6,031.0	0.0	0.0	0.0	0.0	0.0	0.0
213	20,447.0	0.0	0.0	0.0	0.0	1,011.0	0.0
214	8,115.0	0.0	0.0	0.0	0.0	3,987.0	0.0
215	2,147.0	0.0	0.0	0.0	0.0	0.0	0.0
216	10,880.0	0.0	0.0	10,579.0	0.0	0.0	0.0
233	9,718.0	0.0	0.0	0.0	0.0	5,056.0	0.0
234	1,139.0	0.0	0.0	0.0	0.0	841.0	0.0
235	4,449.0	0.0	0.0	0.0	0.0	0.0	0.0
236	0.0	0.0	0.0	0.0	0.0	0.0	0.0
237	2,073.0	0.0	0.0	0.0	0.0	0.0	0.0
238	189.0	0.0	0.0	0.0	0.0	0.0	0.0
239	1,020.0	0.0	0.0	0.0	0.0	0.0	0.0
240	476.0	0.0	0.0	0.0	0.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	0.0	0.0	0.0	0.0	1,080.0	0.0	0.0
243	7,750.0	0.0	0.0	0.0	0.0	0.0	0.0
244	5,881.0	0.0	0.0	0.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	3,796.0	0.0	0.0	3,002.0	0.0	0.0	0.0
254	1,947.0	0.0	0.0	0.0	0.0	0.0	0.0
255	4,770.0	0.0	0.0	0.0	0.0	0.0	0.0
256	32,124.0	671.0	466.0	0.0	0.0	1,478.0	0.0
257	11,995.0	0.0	0.0	0.0	0.0	0.0	0.0
258	6,598.0	0.0	0.0	0.0	0.0	739.0	0.0
259	0.0	0.0	0.0	0.0	0.0	0.0	0.0
260	541.0	0.0	0.0	0.0	0.0	0.0	0.0
261	735.0	0.0	0.0	0.0	0.0	0.0	1,023.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	TABL GRAP	RAIS GRAP	WINE GRAP	FRSH LEMO	PROC LEMO	NECTARINE	OLIVES
206	1,865.0	0.0	12,759.0	0.0	0.0	0.0	0.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	2,941.0	0.0	14,361.0	0.0	0.0	0.0	0.0
209	2,774.0	0.0	11,096.0	0.0	0.0	0.0	0.0
210	11,088.0	0.0	0.0	0.0	0.0	0.0	0.0
211	0.0	0.0	0.0	0.0	0.0	0.0	0.0
212	4,683.0	0.0	0.0	0.0	0.0	0.0	0.0
213	0.0	42,940.0	12,759.0	0.0	0.0	0.0	1,238.0
214	0.0	5,390.0	25,519.0	0.0	0.0	0.0	2,700.0
215	0.0	5,887.0	18,310.0	0.0	0.0	0.0	0.0
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0
233	0.0	54,053.0	0.0	193.0	198.0	3,059.0	2,956.0
234	0.0	1,186.0	0.0	0.0	0.0	0.0	0.0
235	0.0	21,054.0	0.0	0.0	0.0	0.0	0.0
236	0.0	125,347.0	0.0	0.0	0.0	6,518.0	0.0
237	0.0	7,542.0	0.0	0.0	0.0	0.0	0.0
238	253.0	1,516.0	957.0	0.0	0.0	318.0	0.0
239	5,494.0	7,220.0	13,766.0	0.0	0.0	3,561.0	1,705.0
240	5,494.0	1,264.0	7,057.0	227.0	344.0	434.0	5,456.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	4,002.0	18,660.0	65,471.0	455.0	808.0	1,497.0	8,940.0
243	19,069.0	0.0	0.0	455.0	846.0	0.0	1,802.0
244	7,327.0	0.0	0.0	0.0	0.0	0.0	676.0
245	0.0	0.0	1,116.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	909.0
254	0.0	0.0	0.0	0.0	0.0	0.0	0.0
255	246.0	20,860.0	949.0	0.0	0.0	0.0	0.0
256	6,455.0	0.0	27,174.0	227.0	696.0	568.0	1,023.0
257	590.0	0.0	0.0	455.0	1,028.0	0.0	0.0
258	5,229.0	0.0	0.0	227.0	533.0	0.0	0.0
259	0.0	0.0	23,898.6	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	586.0	0.0	0.0	359.0	1,291.0	0.0	0.0

RESULTS OF SJV PRODUCTION MODEL
(CONTINUED)
CROP ACREAGE BY DAU

2000

DAU	FRSH ORNG	PROC ORNG	PEACHES	PISTACHIO	PLUMS	PRUNES	WALNUTS
206	0.0	0.0	6,870.0	0.0	0.0	0.0	14,671.0
207	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	0.0	0.0	8,405.0	0.0	0.0	0.0	6,394.0
209	0.0	0.0	2,557.0	0.0	0.0	0.0	721.0
210	0.0	0.0	9,556.0	0.0	0.0	0.0	581.0
211	0.0	0.0	0.0	2,558.0	0.0	0.0	0.0
212	0.0	0.0	0.0	2,558.0	0.0	0.0	0.0
213	0.0	0.0	2,453.0	0.0	994.0	0.0	1,029.0
214	6,413.0	225.0	511.0	6,006.0	0.0	0.0	715.0
215	0.0	0.0	0.0	0.0	0.0	0.0	0.0
216	0.0	0.0	1,593.0	0.0	0.0	0.0	8,021.0
233	2,703.0	967.0	1,927.0	822.0	2,274.0	1,137.0	3,059.0
234	1,540.0	714.0	0.0	0.0	0.0	0.0	0.0
235	0.0	0.0	2,997.0	0.0	0.0	0.0	0.0
236	0.0	0.0	4,813.0	0.0	3,069.0	0.0	2,908.3
237	0.0	0.0	0.0	0.0	0.0	0.0	887.0
238	0.0	0.0	682.0	0.0	1,137.0	0.0	4,865.0
239	4,359.0	1,718.0	5,452.0	0.0	9,105.0	0.0	0.0
240	12,019.0	5,040.0	825.0	0.0	913.0	0.0	0.0
241	0.0	0.0	0.0	0.0	0.0	0.0	0.0
242	39,998.0	16,972.0	1,137.0	0.0	5,456.0	3,504.0	22,701.0
243	14,894.0	6,369.0	0.0	2,912.0	3,020.0	1,596.0	8,207.0
244	0.0	0.0	0.0	1,179.0	0.0	0.0	0.0
245	0.0	0.0	0.0	0.0	0.0	0.0	0.0
246	0.0	0.0	0.0	0.0	0.0	0.0	0.0
254	426.0	296.0	0.0	0.0	0.0	0.0	0.0
255	0.0	0.0	0.0	0.0	0.0	0.0	0.0
256	7,389.0	4,320.0	1,040.0	3,412.0	1,137.0	0.0	489.0
257	7,027.0	3,823.0	0.0	0.0	0.0	0.0	0.0
258	3,501.0	2,069.0	1,023.0	4,306.0	1,046.0	0.0	227.0
259	0.0	0.0	0.0	0.0	0.0	0.0	0.0
260	0.0	0.0	0.0	0.0	0.0	0.0	0.0
261	1,098.0	471.0	921.0	0.0	0.0	0.0	0.0

7. SUMMARY OF MODELING STUDY

7.1 OBJECTIVES

Several objectives were stated as part of the San Joaquin Valley Hydrologic-Economic Modeling Study. These objectives included:

1. The design and specification of a hydrologic-economic modeling system capable of analyzing the effects of alternate water management policy scenarios. The primary focus was the impact that alternate water supply situations would have on the Valley's agricultural economy.

2. Implementation of the hydrologic-economic modeling system including the collection, with the assistance of DWR, of the data necessary for the construction and testing of the modeling system.

3. Validation of the hydrologic-economic system subject to analytical limitations.

4. Demonstration that the hydrologic-economic system is a viable tool for the use of water managers and planners.

These objectives have all been met successfully. Also, the hydrologic-economic modeling system has been relinquished to DWR and a series of training workshops and the necessary explanatory materials to operate the model have been provided.

The modeling study has been without a doubt the most exhaustive effort of its kind ever carried out for a major agricultural producing area in California.

This report provides an overview of what the modeling study was and what was accomplished. The individual models that make up the HEM system were discussed. This discussion took the form of providing the underlying assumptions of each of the models, discussing each model's structure and data needs, verification of the models, and what each model is capable of producing

for results. Technical reports and users' manuals have been prepared on each of these models, their data bases, and the estimation procedures used to define the different functional components. This review of each of the models was preceded by a discussion about the total hydrologic-economic modeling system. This discussed in a conceptual manner what each model provided in different phases of the study and how the models can be interrelated so that information can feed back through each of them as it is obtained.

The feedback of the models in the HEM system was used to determine what would happen to groundwater depths, pumpage, crop production, land use, water use, and net farm income under two water supply scenarios. These scenarios were run through the HEM system in a manner which would cause the social value of the groundwater resource to be maximized. The results of the scenario runs are in Chapter 6 and they demonstrate the HEM framework's proficiency as a powerful tool for use by water managers and others interested in water allocation in the San Joaquin Valley.

The report also discussed where improvements in the individual models, and hence the HEM system, could be made. Most of these improvements have to do with data limitations. However, given these data limitations the models themselves worked remarkably well, which means that although they are not perfect -- no model of the real world ever is -- the results they provide will be of value to water managers and policy makers.

Additionally, other scenarios that could be run using the HEM system include evaluating the economic and hydrologic feasibility of water transfers (both surface and ground), evaluating different water pricing schemes, and economically evaluating the impact of limiting pumpage and/or pumping depths in specific DAUs in the study area.

Finally, it is assumed that the work on these models will continue -- that is, that as more information about both hydrologic and economic conditions in the Valley become available the models will be refined and updated and the data base used by the models will be continually updated as time goes on.

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